DISCOVERY

A MONTHLY POPULAR JOURNAL OF KNOWLEDGE

EDITED BY A. S. RUSSELL, M.C., D.Sc.

No. 3. MARCH 1920

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PRICE 6d. NET

PUBLISHED BY JOHN MURRAY, 50A ALBEMARLE STREET, LONDON, W.1.

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Edited by A. S. Russell, M.C., D.Sc., 8 Severn Road, Sheffield, to whom all Editorial Communications should be addressed.

Published by John Murray, 50a Albemarle Street, London, W.1, to whom all Business Communications should be addressed.

Annual Subscription 6*s*., or post free 7*s*. 6*d*. Single numbers 6*d*. net; post free 7½*d*.

Editorial Notes

The reception which the reading public has given our first two numbers has been a very good one, and is encouraging to all those of us who wish the journal to take the place among periodicals which we hope it should occupy. To those readers who have sent us helpful advice and criticism we are very much indebted, and as soon as possible, we feel we should like to put all their good suggestions into practice.

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Murmurs of dissent, fortunately enough, have been almost entirely absent, but there is nevertheless one point that has worried several of our correspondents which it may be well to clear up. It is suggested that we were indiscreet in describing, in the first number, operations of offensive and defensive warfare which might conceivably be used by such enemies as we may possess "in the next war." It is a good point, and it needs an answer. The answer is that no secrets or facts of the slightest tactical importance were disclosed in either of the two articles cited. The actual dry facts on which both articles were based have long ago been made public. They are well-known facts in chemistry and physics, the knowledge of which is common property. It is true, of course, that there are many secret processes and "stunts" about which the less said the better. It should be realised, however, that many of these real secrets were communicated to our Allies during the war, so that their co-operation with us might be more effective. These Allies, then, know more of our own secrets than do our general public, so that, if any of our late Allies should be enemies "in the next war," the secrets are out and the mischief is done.

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An important book[1] dealing with the relation of discoveries to general life has been recently published, and deserves general attention. Professor Soddy deals with the effects of discoveries, particularly in natural science, upon national greatness and prosperity, upon peace and war, on education and University ideals, and on human belief. Part of the book is controversial in character, and all the conclusions reached will not command universal acceptance; but the sincerity and vigour with which the author puts forward the need for discoveries, and for the better recognition and treatment by the commonwealth of those who make them, is the important thing about the book.

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The main argument of the book is this: At the bottom of all our material development is our knowledge and control of the inanimate world. This knowledge and this control, however it may be distorted or exploited by men for selfish ends, depends ultimately for its existence on the investigator working in his laboratory. This man works away quietly and patiently, sometimes at great financial sacrifice to himself and often with little public recognition, for the pure love of truth, and the desire to extend the horizons of our knowledge. Men with such ideals, and with the necessary brains and energy, when helped by material resources, are the men who make discoveries. Most of these investigations may seem unimportant at the time, but eventually the importance of some of them is realised, and some new process in industry, or cure in medicine, or instrument in surgery, or help in the ordinary routine of life,

[1] *Science and Life*, by Frederick Soddy, M.A., F.R.S. (John Murray, 10*s*. 6*d*. net.)

results. These men are treasures. They should receive more recognition and help than they do. Nothing is too good for them. Scientific work cannot be done in a garret by the light of a candle. It needs apparatus and money. Money must therefore be forthcoming if research work in pure science is to continue, and, if it be forthcoming, whether from the Government or privately from men of wealth, it should be devoted to the cause for which it was given, and not diverted into other channels, as Professor Soddy argues so much of it has been in the past.

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Einstein's theory of relativity has come to stay, so, however complex and incoherent it may appear to us at present, we must, we suppose, try to grasp what it is all about. In recent numbers of *Nature* this subject has been dealt with by many writers and correspondents, and certainly it has been made more understandable than it was in the original accounts. A good description of the theory was given by Professor Lindemann of Oxford in a recent number of the *Times Educational Supplement.* An English translation of the book by Professor Einstein himself is announced for the spring.

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Professor Pear's article in the first number on the Psychology of Dreams has aroused great interest. We have decided, therefore, to deal from time to time with other branches of psychology. This is now an experimental science which, although it is of comparatively recent date, is already of great importance, and also of great human interest. Its main foundations are well and truly laid, and it appears to have a very promising future. During the war psychology was brought into great prominence, because of the extraordinarily good work done by its workers in the treatment of nervous disorders in soldiers resulting from the war.

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We wonder if it is realised, as it ought to be, how much good original poetry and prose in our own language is being written at the present time. With peace has come a large output of imaginative writing, the best of which should not be passed over or left unread until the critics of the next generation tell those of us who are then alive what great fellows contemporary writers are. The best of the literary weeklies and monthlies are very much alive, and for those who have not time to wade through everything that is published, but time only to read what is worth while, they act as very helpful and pleasant guides. To discover the best writers of to-day, and to rediscover the best of the literature of the past, that surely is a good piece of work we can set ourselves to do.

Lapsed Memories

By P. B. Ballard, M.A., D.Lit.

Inspector of Schools, London County Council

WITHIN the last decade psychological interest has been transferred from remembering to forgetting. The psychologist is now less concerned in explaining how we remember than in guessing how we forget; and especially in guessing what it is we have forgotten. For it is now a well-established theory that forgetting—or, rather, a certain kind of forgetting—is the cause of serious nervous disorders, such as hysteria, and certain forms of incipient insanity. The proof lies in the fact that when the patient ceases to forget he ceases to suffer: with restored memory comes restored health. This simple truth came into marked prominence during the war. Shell-shock, with its distressing symptoms, is as a rule traceable to forgetfulness. The sufferer cannot, for all his efforts, recall what happened in those moments of peril and terror that broke down his nerve; nor, indeed, the events that immediately followed. And when, under hypnotic treatment, or by that more tedious but more efficacious mode of probing the mind known as psycho-analysis, he is enabled to retrieve his lapsed memories, the symptoms nearly always disappear—often with surprising suddenness. When they still persist, in large measure or small, it is generally found that the root of the trouble lies still further down, in some earlier forgetfulness that had already weakened the resistance of his nerves.

Here we have a kind of forgetting which brings suffering in its train, and demands, in the interests of human happiness, a careful study. It is clear that, as a rule, forgetting is a perfectly harmless process; nay, even necessary and beneficent. To rid the mind of lumber is a wholesome thing to do; and to rid it of learning does no great harm. There is no reason to think that those of us who have forgotten some of the things we learnt at school are, from the point of view of health, any the worse for our forgetting; it is certain that efficient thinking depends on a judicious forgetting—on a leaving out of the unimportant and the irrelevant. Physiologically speaking, memory depends on a modification of the nervous system: every experience leaves a trace there, and that trace is the basis and guarantee of its recall. But as time passes since their last revival these traces gradually fade away, and the memories they underlie get more and more difficult to call back to consciousness. Many of them, indeed most of them, never come back at all. That is the normal and healthy process of obliviscence—a gradual passing of our experiences into oblivion—a process mainly dependent on the time that lapses since they were part of the actual thinking

mind. The deeper impressions will take longer to fade away than the fainter ; but fading is the inevitable fate of them all.

How, on this basis, can we explain the forgetfulness that leads to shell-shock ? Why should the victim forget an experience which must have made a profound impression upon him ? To all appearances it seems just the sort of experience that a person would be least likely to forget. To explain this obliteration of so moving, so disturbing a memory, we must postulate another kind of forgetting which differs totally from obliviscence. Obliviscence attacks the weak ; this the strong. Deep emotion hinders one and favours the other. Obliviscence acts gradually, and gently carries the experience over the line that separates the recoverable from the irrecoverable ; this other forgetting suddenly and violently pushes the experience beyond the limit of recall. In one case there is a slow and steady sinking into the unconscious, in the other a sudden fall.

This latter type of forgetting has by the new school of psychologists, the psycho-analysts, been termed "repression" ; and the resulting forgetfulness has for many years been known as amnesia. Is repression a normal process or is it pathological ? Is it a healthy or harmless thing that, like obliviscence, happens to everybody, or is it a malady that happens to few ? Dr. W. H. R. Rivers favours the former theory.[1] He maintains that repression has a definite biological value. There is probably in the mind of man a machinery of repression which works on the whole for his benefit and comfort ; there is certainly some such machinery in the mind of the lower animals. The frog, for instance. In the early stages of its life it is a fish, a tadpole. It inherits fish-like instincts and acquires fish-like habits. It breathes with gills, has a very serviceable tail, and useless rudimentary legs. But when it becomes a frog it gives up fish-like things. It lives on land, breathes with lungs, has very serviceable legs, and a useless vestigial tail. To forget the experiences and habits of tadpoledom, and to acquire a new set of habits and customs, is the whole duty of frogdom. But simple obliviscence is far too slow a process to help him within the necessary time. For of all memories, motor memories, when organically fixed, seem the most difficult to forget. The swimmer, after long years of abstinence from the water, swims as readily as if there had been no intermission at all. In fact, repression must have been at work. The frog forgets his infancy, the full-grown insect forgets the metamorphoses through which it has passed.

This survival value of repression in the lower animals suggests the function of repression in the human mind. It may be useful in the preservation of life ; or, on the other hand, it may be the vestige of a process once useful, but now indifferent or even harmful. By dealing with the concrete facts, and quite independently of such biological speculations as I have outlined, the psycho-analysts have arrived at the conclusion that repressed material is always unpleasant. The motive for repression is one's personal comfort. One represses to preserve one's peace of mind. This is obviously so in the case of shell-shock ; it is demonstrably so in the case of hysteria ; it is probably so in other and less harmful forms of repression. The shell-shocked soldier had to face terrors that were more than he could bear ; be became unconscious and forgot ; a beneficent Nature threw over his mind a pall which, although it ultimately did him harm, preserved him at the time from a still greater harm—death from shock.

The curious amnesias of hysteria I have no space to discuss : I must content myself with an illustration from one of the common occurrences of everyday life—the forgetting of proper names. Why are people's names so hard to remember as compared with other words ? Why does one particular name sometimes slip out of the mind and defy all efforts at recall ? The most plausible explanation seems to be that we think of a friend in pictorial terms. We catch in imagination a fleeting glimpse of his face, or of some characteristic feature of dress or person, which serves as his symbol and saves us the trouble of recalling his name. I cannot in this way envisage an abstract relation : to think clearly of general and abstract things I must think in words. And thus it comes to pass that my friend's name, unless I have to speak it aloud, tends to fade away through sheer lack of repetition. Now mark how the psycho-analyst explains it. He holds that, when we are prone to forget a person's name, it is because we dislike him, or because there is somebody else of the same name whom we dislike ; or because his name, or his dress, or his face, or his conduct is in some way, direct or devious, connected with some unpleasant experience of our own, and the censor (as Freud calls the repressing force), to make assurance doubly sure, not only represses the unpleasant experience itself, but also all the mental factors that are likely to bring that experience back to consciousness. It may be that we are unconscious of this connection (indeed, we generally are), but the connection is there, and if sufficient trouble be taken it can be brought to light. For a full defence of this position I must refer the reader to Dr. Ernest Jones's article on "The Theory of Repression in its Relation to Memory."[2] It must not be thought that these two theories, obliviscence and repression, are alternative theories, one of which

[1] *The British Journal of Psychology*, vol. ix, pp. 236-46.

[2] Ibid., vol. viii, pp. 33-47.

must be accepted and the other rejected. The probability is that both theories are valid, and that neither in itself affords a complete explanation of the facts of forgetting.

Having dealt broadly with forgetting, we must now consider the second part of our problem: How are these lapsed memories (the things we can't remember as distinct from those we merely don't at the moment remember) to be brought back to consciousness? How can Jekyll remember Hyde, and Hyde Jekyll?—for such cases of double personality are forms of amnesias not unknown to science. How can the forgotten name be again remembered? If simple obliviscence were the one universal law, then all mental impressions would gradually fade away until they got beyond the limit of recall, where they would for all practical purposes disappear. But obliviscence is at least partially counteracted by an opposing tendency towards what I have elsewhere called Reminiscence [1]—a re-remembering of the forgotten. We attend a concert and hear a catchy tune, but fail to recapture it next day. But ultimately it comes back to us of its own accord as it were, and we can sing it without hesitation and without doubt. This is reminiscence. Again, we try to recollect the name of an acquaintance, but fail and give it up. In an hour or so, when we are thinking about something else, the name we want leaps unexpectedly into the mind. This, again, is reminiscence, a process common enough among adults, but commoner still among children. If a class of children be given a limited time to learn by heart a piece of poetry, it is found, by testing them, that on the whole they remember more two days after they have learnt it than they do immediately after learning it. Lines that had eluded them at first come back to them at last. As a final example of reminiscence, I will suggest a significant experiment which the reader may make upon himself. Let him select a clearly defined part of his past life, such as a holiday he has spent abroad, and let him jot down all the events of that period that he can remember. If he then dismisses the matter from his mind, and after a day or two tries to add to his notes, he will find that many of the things which he had failed to recall on the first occasion are now clearly remembered. And after further periods of rest he will find himself remembering more and more. And the same thing will happen if, instead of a period of his own life, he selects a period of history which he studied years ago, or a poem which he once memorised, or a branch of science that he once mastered.

He will, in any case, realise the important fact that, when one memory is called up from the depths of the unconscious, it tends to bring up other memories with it; when one idea recrosses the border-line that separates the recoverable from the irrecoverable, it tends to pull across the border other ideas associated with it; and, given sufficient time, these other ideas will one by one come across. To start this crossing of the border we must, of course, begin with ideas that lie on the conscious side of the line. These experiments force us to the conviction that the association links that bind our experiences together still exist after the experiences themselves have sunk into the unconscious. This is the basal fact upon which the psycho-analysts rely in their quest for that group of lost memories which they call a "complex," and which they believe to be the source of some neural and mental disturbance. There is some difficulty in finding a suitable starting-point; but as Professor Pear pointed out in the January number of this journal, the patient's dreams supply a clue to the track that leads to the hidden complex.

Sir William Hamilton, many years ago, remarked that it was probable that all our memories were preserved, and that it was forgetting, and not remembering, that called for explanation. And the view was regarded as fantastic and quite unsupported by fact. But in this, as in other things, the heterodoxy of yesterday is fast becoming the orthodoxy of to-day. For the number of amnesias that have been cured, the number of experiences, minute and detailed, that have been gradually brought back from the limbo of the past, the number of memories that have in certain abnormal states been reproduced with almost phonographic faithfulness, have led modern psychologists to suspect that nothing that has ever been experienced is really lost. Nay, it need not even be experienced. Things seen or heard, but not noticed, like the multitudinous pictures that fall upon the margin of the retina, have been faithfully described by patients during an hypnotic trance.

I have but touched the fringe of a tremendous subject, a subject full of undreamed-of possibilities and teeming with unsolved problems. I have not touched upon the theory of different levels and layers of consciousness; nor upon the way in which a complex sometimes grows until it seems to form a separate self which may gain the ascendancy over the normal self, and give rise to alternating personalities, as though two souls occupied the same body.

And the facts revealed give abundant scope for metaphysical speculation. In this I will not indulge, but merely remark that the term "integrity," as applied to a man's character, takes on a fresh meaning; and that new light is perhaps thrown on the line from Wordsworth's ode: "Our birth is but a sleep and a forgetting."

[1] "Obliviscence and Reminiscence," *The British Journal of Psychology*. Monograph Supplement, No. 2.

The Biological Problem of Cancer

By J. A. Murray, M.D.

The Imperial Cancer Research Fund, London

THE problem of the nature and causation of Cancer is one of perennial and baffling interest. The disease has existed from the earliest times, and to-day still takes a heavy toll of humanity. Its ravages are not confined to mankind ; domesticated and wild animals, birds and fishes, all are subject to it in varying degree. In all it presents the characters of a cellular local overgrowth of some part of the body, growing progressively till it destroys life. A mountain of paper has been covered with descriptions of the details of the structure of cancer, its naked-eye appearances, the course of the disease, and numerical tables of its frequency in successive years in all countries. It would be futile to attempt a summary even of the salient facts embodied in all this recorded experience within the limits of the present essay, which must be restricted to a statement of the central problem, the kernel of cancer research, as it appears to the writer.

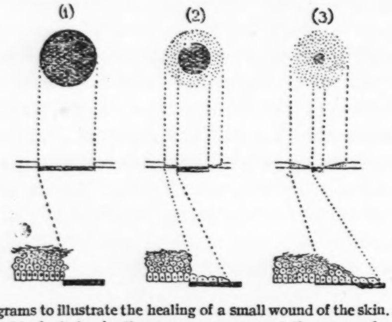
As a preliminary, some elementary facts of the structure and life-history of living things must be touched upon. Underlying the diversity of appearance and complexity of the bodies of the higher animals (to which it is convenient to restrict ourselves), there is a surprising uniformity of structure. Skin, bone, blood, brain, liver, and intestines, all are made up of "cells," microscopic in size, differing in detail, but all built on the same plan. In the warm-blooded animals like ourselves their size is such that, placed end to end, from 1,000 to 3,000 will lie in the space of an inch. They are of a semi-fluid or watery consistence, and in each there lies a denser spherical body, the nucleus. The surrounding clear substance is termed protoplasm, and with the nucleus is the repository of the processes of life. Masses of cells of the same kind are called tissues—e.g. nerve tissue, epithelial tissue (covering the surface of the body and lining the intestines), muscular tissue, and so forth. The organs of the body, such as the brain, the heart, the liver, are made up of a number of tissues modified and arranged for the work they have to do. Careful measurements have been made of the cells of corresponding tissues from giants and dwarfs, and their sizes have been found to be the same. The difference in size of the individuals in question is therefore due to the greater number of cells in the body of the giant. The same holds good for the tissues of children and adults: their cells are of nearly the same size, but there are more of them in the adult. Similarly the corresponding cells of a rat and a horse are nearly of the same size, and they are correspondingly more numerous in the larger animal.

How is this uniform size of the cells maintained while their number increases ? In the simplest manner imaginable. If we examine the cells of the liver of a new-born mouse, we find that in a considerable number the central spherical nucleus has divided into two, and then a constriction appears in the surrounding protoplasm. The constriction gradually deepens till the cell is cut quite through, and two cells, each half as large as the original, result. In a growing animal the two daughter cells produced in this way rapidly increase in size, till they are as large as their predecessor, when the process is repeated. This alternation of division of cells, and increase of the daughter cells to the previous size, is the universal mode of growth in the higher animals. As everyone knows, the process is more rapid in the young. A child which weighs seven pounds at birth may be three times as heavy at the end of the first year of life. As age advances the process slows down, and a time arrives when the size becomes constant, and we say that growth has ceased. Careful and minute study of the cells of adult men and animals shows, however, that cell-division is still going on in many of them. This is usually regarded as a provision for replacing cells worn out or damaged in the business of life. From another standpoint it may be regarded as a slower continuation of the growing process which is so obvious in early life. In extreme old age it becomes still slower, and is no longer adequate to keep up the size of the body. The very old seem to shrink in bulk and stature, and when the failure reaches some organ essential to life, such as the muscular tissue of the heart, life sinks to its final ebb.

Two remarkable properties of the living body lessen the similarity which this sketch conveys of machine-like regularity, as of a watch wound up and allowed to run down. The individual cells of the various tissues are not independent, self-contained units, each going its own way. They are subject to a general controlling influence, the nature of which is still obscure, which limits their rate and amount of growth, so that a fairly uniform proportion is maintained between the different organs and parts of the body. The reality of this regulating mechanism is also shown by the fact that the different animal species (and even the smaller racial groups), each attain a characteristic average size. The rat, the lion, the terrier, and the mastiff, will occur to everyone. In the same way sheeps' hearts or kidneys are always pretty much of a size, and smaller than the corresponding parts of the ox. We shall see that a failure of this controlling in-

fluence is closely related to the origin and growth of cancer.

The second peculiarity of living things is one which is of the greatest importance to the well-being, and in fact the existence, of man and animals. It is within the experience of everyone that the tiny patch of skin which is knocked off by accidental contact with a sharp table corner is quickly replaced. As soon as bleeding stops, either by the application of pressure or, as we say, of itself, a red glazed surface forms. The edges of the little wound, which were at first irregular and steep, become shelving, and the opaque white surrounding healthy skin thins off to a translucent bluish edge. This creeps in over the red, raw surface from every side till the whole defect is repaired. It is worth while to go into the details of the process, so far as the outer layer of the skin is concerned, with the aid of the accompanying diagrams. Let the three black



Diagrams to illustrate the healing of a small wound of the skin. The three black circles in the upper row represent the raw surface uncovered by skin, as seen from the surface. The second row shows the wound, on the same scale, as if cut across and viewed from the cut surface. The third row shows the appearances of the margins in the second row, more highly magnified to show the single cells. Dotted lines join the corresponding parts of the three sets of figures.

circles 1, 2, 3, represent the raw surface as soon as bleeding has stopped (1), next day (2), and on the day after (3), when healing is nearly complete. Below, on the same scale, are the appearances that would be seen if the wound were cut across and viewed from the cut surface—that is, in section. The third row of figures shows the appearances seen when a thin slice from this cut surface, suitably prepared, is examined under the microscope. The outer layer of the skin consists of several layers of cells, the outermost of which are flattened, dried, and horny. These are dead and are being constantly rubbed off, insensibly for the most part, in visible shreds when a Turkish bath is taken. They are replaced by division and growth of the cells of the deepest layer, which look like a row of bricks stood on end. This basement layer is the only one capable of cell-division, and alone takes part in the process of repair. The cell of this layer next the defect divides into two, and the new cell next the raw surface is pushed out over it. Still retaining contact with its parent, it flattens out and itself divides. The mother-cell divides again, and the process goes on till a considerable part of the edge of the wound is covered by a single layer of flattened growing cells. Those nearest the undamaged skin soon acquire the elongated form of the deepest layer (3), and when they divide, one of the daughter cells is pushed upwards and repeats the appearances first described. The new skin thus increases in thickness till the outer surface is flush with its surroundings. When this stage is reached, the rate of cell-division slows down again to the original speed.

The important points for us to notice in this process are, first, that the cells of the skin can be wakened up from the ordinary rate of reproduction and excited to more rapid division and growth by removal of some of their neighbours; and, second, that when the gap has been mended, the temporary spurt is checked, and the cells return to their regular workaday jogtrot. It is very probable that reciprocal influences of cells of the same kind on each other are in part responsible for this opportune halt. A complete explanation, which does not attribute semi-intelligent action to the cells, is yet to seek. It has an unmistakable resemblance, however, to the regulating power, already mentioned, which maintains the just proportion of the different parts of the body. Repair processes, essentially of the same kind, take place in the deeper parts of the skin after such a slight wound as has been described. In other organs, also, destruction and damage are followed by a similar response.

The description of the various agents which cause damage to the tissues, and the peculiarities of the alterations they produce, is the province of the science of pathology. It will be sufficient to draw attention to a few examples of agencies which produce rather less obvious forms of damage than the simple abrasion just described. Workers in paraffin-oil refineries, after long-continued action of the oil on the hands and arms, frequently suffer from a slow inflammatory condition of the skin. When the irritated condition of the skin has persisted for some time, numbers of warts make their appearance. Warts are circumscribed overgrowths of the covering layer of the skin. We may assume, either that some kind of damage to the cells of the skin releases them from the regulating power which restricts their rate of multiplication, or that substances in the oil excite the cells to division in spite of the restraining influence. The majority of such warts after attaining a certain size cease to grow. If the special irritant which caused them be removed, they usually diminish in size and may disappear. If the irritation be continued, however, further changes take place in some of them indicating a profound alteration in character. Instead of re-

maining stationary in size, they begin to grow slowly. Bleeding occurs with or without injury, and the dried blood forms a black, hard incrustation or scab. When this is removed, a raw ulcerated surface is exposed. The margins of the ulcer are thickened and hard. On microscopic examination the thickening is seen to be due to multiplication of the cells of the outer layer of the skin. Instead of covering in the defect in the surface as described for the healing of a small abrasion, the cell masses are arranged irregularly, and break down nearly as soon as they are formed. In this way the ulcer continues to spread, always surrounded by a wall of irregularly built up skin. If nothing be done to arrest its course, severe blood-poisoning sets in, due to the entrance of bacteria into the blood-stream, or a large blood-vessel is involved by the friable newly-formed epithelial cell-masses and death results from hæmorrhage.

Such a progressive cellular overgrowth is described as cancerous, and the description given for cancer of the skin applies, with slight modification, to cancerous ulceration of the lip, tongue, stomach, and intestines. In parts remote from the body surfaces growth extends in all directions fairly equally, and the newly-formed cells, even if they break down, are not removed, so that the resulting mass is approximately spherical. Varying resistance of the parts encountered by the growth in its progress causes departure from the simple geometrical form. The one constant character common to all is the continuous new formation of cells going on till death results.

It will have been noted that emphasis was laid on the long duration of the irritation which precedes the definitely cancerous stage in the evolution of the skin warts produced by paraffin. This is a very common feature in the antecedent history of cancer in many parts of the body. As is only natural, this is especially noticeable in cancers on the surface of the body, since the ease of observation permits us to recognise slight degrees of damage which might not reveal their presence in the deeper parts. Long-continued or chronic irritation, then, is a very frequent precursor of cancer, and this necessity for a considerable lapse of time for chronic irritation to end in cancer is probably one of the main reasons for its predilection for later life in man and animals. The kinds of irritation may be very varied, provided they are not too severe and last a long time. They may be chemical, as we have seen in paraffin cancer and pitch warts, or soot which produces the very fatal chimney-sweep's cancer. Radiant energy is responsible for cancer of the shins of railway-engine drivers, for cancer of the chest opposite the opening of the burnous of the Soudanese, or X-rays for cancer on the hands of X-ray operators. The irritation of animal parasites has been followed by cancer of the tongue and stomach of rats (Spiroptera cancer), and of the urinary bladder in the human subject (Bilharzia cancer), and so on. From this great variety it can be seen that measures for the prevention of cancer cannot be divorced from those needful for the general improvement of the conditions of life. In accordance with this, Dr. Dublin has found a greater liability to cancer in American wage-earners than in those in easier social circumstances, and Dr. Stevenson has shown that the maximum number of deaths from cancer in public institutions in this country tends to occur at ages definitely lower than in the general population.

Keeping in mind the facts that cancer begins in a circumscribed area and increases in size by a continuous multiplication of cells, the crux of the problem presented by it is seen to be: How are the cells in the localised area concerned, started on their altered tempo of growth, and why are they unaffected by the restraining influence which normally holds the cells of the rest of the body within their proper bounds? It would be very natural to assume that a weakening of the restraint which the cells of the body exert on each other is merely a part of the general weakening of the natural forces accompanying old age, in which, as already noted, cancer is progressively more likely to develop. A special circumstance has enabled us to eliminate this possibility, rendered unlikely by the fact of the circumscribed origin of these growths and the rarity with which they attack more than one tissue in the same individual. The circumstance alluded to is the occurrence in certain animals of cancerous growths which can be grafted successfully into normal animals of the same species. Most of this work has been done with mice and rats. A careful day-to-day study of the site of inoculation shows that there is no question of the cells of the inoculated animal's body becoming cancerous. What happens is that the cells introduced continue to grow until they form large masses of cells. The process can be repeated indefinitely in a succession of mice. It is not even advantageous to select old animals. Grafting succeeds better in young ones. Clearly, then, the rapid and continuous growth of cancer cells cannot be due solely to the weakening of the restraining influence on growth in the body of the cancerous subject. On reflection, there seems to be no escape from the conclusion that the cancer cells behave as they do because they are different from their neighbours. They have undergone a change in becoming cancerous, by which they no longer respond to the influences which restrain and regulate cell-division and growth in the body. Whether this change is a real increase in the energy with which the cells take in food and grow, so that the restraining influence is powerless to hold them in check, or whether

it is a loss of sensitiveness to restraint, cannot be said with certainty at present. Although some cancers can be seen to increase in size from day to day, others progress so slowly that it may take months to be certain of any change, and the latter are no less fatal. The problem is subtle and alluring, and it is doubtful if it can be yet stated in a form suitable for direct attack. Until progress has been made, the causation and origin of cancer can only be partially comprehended, for we simply do not know what it is that arises, or is caused.

Another possibility, which has exerted a considerable influence on the course of cancer research, is that the cancerous change is due to the entrance of a microbe, with peculiar properties, into the cells prepared for its reception by chronic damage. Dr. Peyton Rous, of New York, has discovered that certain tumours of the domestic fowl can be transmitted to other fowls without transferring the intact tumour cells. These growths are indistinguishable, in structure and in the course of the disease, from true cancers. The agent responsible is almost certainly a microbe, so small that it lies below the limit of microscopic vision. These observations of Rous have been hailed as indicating the direction in which to look for the explanation of all cancers, but even the most enthusiastic supporters of this point of view will admit that it is still unproved, except for three or four cancer-like growths of the domestic fowl. Experiments to test this explanation on the tumours of mice and rats and of man have failed completely.

One of the great disadvantages which retards progress in the study of cancer is the absence of a means of producing the disease at will in experimental animals. Although, as has been already mentioned, we can carry over cancer cells from an animal in which it has arisen to healthy animals, and produce in them all the symptoms of the disease as it occurs naturally, it is not yet possible to induce the cancerous transformation at will in the cells of normal animals within a reasonable time. Prolonged exposure of rats to X-rays has in a few instances been followed by cancer, and experiments are at the present time being carried out in different countries with pitch and tar to try and produce the form of cancer which follows chronic irritation with these substances. It may be asked whether all individuals are equally liable to develop cancer under chronic irritation. The differences which have been observed in the parts of the body most frequently attacked by cancer in the different animal species and races of men, are sufficiently definite to make this unlikely. Even such closely related animals as rats and mice suffer from cancer in very different organs. Breeding experiments with mice have been carried out on a large scale here and in America, and have shown that it is possible to obtain stocks which differ enormously in their liability to develop cancer. The excessive liability which some of these stocks show can be transmitted to their offspring. It is therefore probable that hereditary predisposition may play a part in human cancer also, but, as is obvious, such intensive selective mating as has been carried out in mice is unlikely to occur accidentally in man.

The conception presented in the preceding pages is that cancer involves a local disturbance of the delicately balanced mechanism which, running smoothly in the healthy body, maintains its component cells as a harmonious whole. Beyond stating that the disturbances must have taken place and been perpetuated in the cells, which by their continuous division make up the cancerous growth, little is known. Those engaged in the study of cancer are heartened in their work by the conviction that, soon or late, the human mind will penetrate and master the intricacy of these balanced forces, and therewith bring the growth of cancer under control.

BOOKS SUGGESTED FOR FURTHER READING

Tumours, Innocent and Malignant. J. Bland-Sutton.
The Pathology of Tumours. E. H. Kettle.
The Experimental Study of Cancer: A Review. W. H. Woglom.
Lectures on the Pathology of Cancer. C. Powell White.

The Stamp Act ot 1765

II. What George Grenville Did—and What He Ought to Have Done

By C. H. K. Marten, M.A.

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In the last number of this Journal the conditions and circumstances preceding the fatal Stamp Act were discussed. The British Government, as the Colonies seemed unwilling or unable, owing to their different circumstances and jealousies, to combine for their own effective defence, had decided that it was necessary to keep a permanent force of 10,000 men in America for defence against the Indians, a most dangerous rising of whom had just been suppressed. But the question arose who was to pay for this army? The head of the British Government at this time was George Grenville. He belonged, perhaps, to the most

important political family at that period in England.[1] All his four brothers were at one time or another in Parliament, and three of them were Privy Councillors. He himself and his son both became Prime Ministers, the father in 1763, the son in 1807. His brother-in-law, the great Pitt, with whom, however, he was not in 1765 in agreement, had just won the Seven Years' War for England; his nephew, the younger Pitt, aged only six in 1765, was to be Prime Minister before he was twenty-four, and to hold that office longer than any succeeding statesman. George Grenville himself was industrious and capable, with considerable knowledge both of Finance and of Law. But his overlong speeches bored both the King and the House of Commons; and it was unfortunate for Great Britain that he was extremely obstinate, and above all possessed no tact. "Able, narrow and laborious," are the epithets Lord Rosebery applies to him; "He had a scientific and unimaginative temperament," says Mr. G. L. Beer, the American historian, "with a distinctly legal turn of mind." Some of his contemporaries were more emphatic in their opinions: "I would rather," said George III after Grenville's resignation, "see the devil in my closet than George Grenville"; and Horace Walpole, the diarist, calls him "that mulish carthorse."[2]

Let us see how Grenville, with his unimaginative and legal turn of mind, tackled what was undeniably a difficult situation. To him, as well as to many others since his time, it did seem unfair that the Mother-country, with her debt doubled as the result of the Seven Years' War, and paying the whole expenses of the Navy, should be called upon, in addition, to pay the whole cost of an army designed exclusively for American defence. He accordingly, first of all, passed a Sugar Tax, the most important item of which was a heavy duty on molasses from non-English Colonies—molasses being necessary for the manufacture of rum in Boston. The tax was partly to protect the English West Indies producing molasses, and partly to produce a revenue; and is a good illustration, incidentally, of the difficulties of arranging, without inflicting hardships, colonial preferences within an empire.

But, though this Act was unpopular, it was the second of the two Acts of George Grenville round which the great controversy was to rage. This was the Stamp Act, ordering all bills, bonds, leases, newspapers, cards and dice, etc., to have stamps, the duties varying from a halfpenny to £10; they were like similar duties in England, only they were lighter than those paid in the Mother-country.

The Stamp Act has been fiercely attacked, and England has been, and is still, accused of injustice in regard to it. But it is only fair to Great Britain and to George Grenville to point out that there was a great deal to be said on Grenville's side. In the first place, his legal position was unassailable. Parliament had the undoubted right to legislate for the Colonies, and that included the right to make laws imposing taxes, whether they were levied at the ports or levied internally. No one denied that the Parliament could legislate about Colonial Commerce; and Imperial Defence, after all, was an equally important matter.

Moreover, quite apart from what was legal, it cannot be said that Grenville's position was really unreasonable. After all, the proceeds from the Sugar Tax and the Stamp Act were only expected to produce something between half and one-third of the cost of this army, the remainder being paid by the already over-burdened Mother-country, whose debt had doubled and expenditure increased threefold since the beginning of the Seven Years' War. Moreover, as Mr. Lecky points out, "Every farthing which it was intended to raise in America, it was intended also to spend there." Then, again, Grenville allowed a year to elapse before he passed the Act in order that the Colonies might think of an alternative. He called a meeting of the agents of the Colonies in London and said, "I am not set upon this tax; if you can tell me of a better I will adopt it." But the agents could not agree upon any other tax which the Colonies themselves might impose. And, though the Stamp Act met with plenty of critics later, the storm it would raise was not foreseen by other statesmen in England. The great Pitt was ill, otherwise he would have opposed it; but the Bill was carried after a languid debate in the House of Commons, and without division or discussion in the House of Lords. And, indeed, both the Colonial agents in England and politicians in America failed to gauge the strength of the opposition.[3]

What happened when the Stamp Act—the "fatal Black Act"—came into force in the Colonies, on

[1] For a brilliant description of Grenville's family see *Chatham, His Early Life and Connections*, by Lord Rosebery (1910), pp. 130–41.

[2] Grenville's nickname at the period was "The Gentle Shepherd." For in a speech in 1763 he had attacked Pitt's extravagance in the Seven Years' War, and asked those Members who opposed one of his budget taxes to say *where* a new tax could be laid. "I say, sir, let them tell me where. I repeat it, sir, tell me where!" On which Pitt, who was one of the Opposition, hummed to the great delight of the House a then popular ditty, "Gentle Shepherd, tell me where!"

[3] Thus James Ingersoll, the agent of Connecticut, obtained, and Richard Henry Lea, a prominent politician in Virginia, applied for, posts in connection with the collection of the Stamp Duties; both had some difficulty in explaining away their conduct later.

November 1, 1765, is well known. The bells were tolled as for a funeral, the flags were put half-mast, and the shops were shut.[1] There was a general suspension of business with England, and a complete refusal on the part of anyone to use the stamps. The "Passive Resistance" movement was complete and triumphant. Most ominous of all, representatives from nine Colonies met to protest—the first common action ever initiated by the Colonies.

Why, it may be asked, if Grenville's position appears so reasonable, did the Stamp Act arouse such opposition? The answer is that the Colonists were Englishmen, and Englishmen brought up in the traditions and principles of English liberty. Theirs was the same cause as that of Hampden in the previous century. Ship Money, against which Hampden protested in 1637, was a tax instituted and used for the admirable purpose of guarding the seas, and incidentally produced the first three-decker, the *Sovereign of the Seas*. The Stamp Act of 1765 was instituted for the admirable purpose of guarding the American frontier against attacks such as those of Pontiac. Ship Money was probably, and the Stamp Act was certainly, legal; but the one tax in England and the other in America met with the fiercest opposition. But there is this difference between John Hampden and the American Colonists. John Hampden objected to the Ship Money because it was not voted by the English Parliament; the American Colonists objected to the Stamp Act because it was. It is quite a mistake to suppose, as it is stated in so many textbooks, that the American Colonists revolted because they were not represented in the British Parliament. This, in the words of Professor Pollard,[2] was "no more the origin of the American War of Independence than Edward III's claim to the French throne was of the Hundred Years' War."

As we have seen in the first article, the Colonists had acquired, during the previous half-century, virtually complete self-government. They had been allowed to develop themselves, not altogether without restraint, but in effect largely so; and the control of taxation by their own Assemblies had become almost a mania with them. Grenville, in trying to impose the Stamp Act through the British Parliament, was trying, though he did not realise it, to put back the hands of the clock. Or, to change the metaphor, he was like a parent trying to treat a boy of eighteen as if he were a boy of fourteen. The American Colonists had reached manhood—they could be treated as children no more, and they objected to the absolute sovereignty of the British Parliament, though perhaps willing to recognise the authority of the Crown. "Is there not something extremely fallacious," said the famous American, John Adams, in 1765, "in the commonplace image of the Mother-country and Children-colonies? Are we children of Great Britain any more than the cities of London, Exeter, or Bath? Are we not brethren and fellow-subjects with those in Britain?"

The opposition of the Colonies is one of which both Great Britain and the United States may well be proud. Professor McLaughlin, the distinguished American historian who lectured in England in the spring of 1918, has well expressed the point of view from which that opposition ought to be regarded from both sides of the Atlantic. "The American Revolution," he says, "is, on the whole, the chief jewel in the Imperial diadem of Britain; it was one of her greatest deeds. It was based on English-born philosophy; it was waged by Colonists who had developed in freedom. . . . None but English Colonies, as we have seen, could have made such a fight for independence. . . . No one but Englishmen established American independence, and this they did on the basis of English History."[3]

But, whilst we may be proud of the Colonies, let us be just to the Mother-country. In the first place, neither the British people nor their statesmen were anxious to assert or to exercise the right of taxing America.[4] In the second place, the Stamp Act, though passed in 1765, was repealed in 1766, and Pitt the foremost, and Burke the best informed, of English statesmen, made some of their greatest speeches in opposing American taxation.[5] In the third place, let us realise once more that Grenville was in a difficult position. It is easy enough to see that he did the wrong thing—but extremely difficult to see what was the right thing to do. The present writer has corresponded with English and American historians on this point, and has failed to elicit a completely satisfactory reply. No doubt Grenville might have let Great Britain bear, in addition to all her other burdens, the whole pecuniary burden of the new force—but was that quite fair to the Mother-

[1] The more ardent of our Colonists settled to eat no more lamb, so as to have more wool for making their own clothes.

[2] See an admirable article on "No Taxation without Representation" in *History*, October 1918.

[3] See *America and Britain*, by Professor McLaughlin (1919).

[4] See *Project of a Commonwealth*, part i (1915).

[5] Sir George Trevelyan prefaces his *History of the American Revolution* with an account of the condition of Eton at that time, and seems to imply that Eton, the home of the ruling aristocracy, was partly responsible. As one who has spent the far greater part of his existence at Eton, the present writer cannot refrain from alluding to the fact that if Eton produced George Grenville, the author of the Stamp Act, and Lord North, the conductor of the American War, she also produced Lord Chatham, the greatest opponent of the Stamp Act, and Charles James Fox, the greatest opponent of the war.

country? Or, he might have left the Colonies to look after their own defence, and find out by adversity the necessity of union for this purpose—but such a course would have been contrary to British traditions of Empire, and might have led to great disasters for the Colonies. Or, again, he might have allowed American representatives in the British Parliament. An English diplomatist, at the beginning of the nineteenth century, was told by two successive American Presidents, Madison and Jefferson, that if this had been done the Stamp Act would not have been opposed; but, as a matter of fact, neither the Colonies nor the English, in 1765, wanted American representation in the British Parliament, and, in particular, Burke ridiculed the idea owing to the distance and the slowness of communications.

Lastly, let it be remembered, in Grenville's favour, that the problem of Imperial Defence, which proved the grave of his reputation, has not, as a matter of fact, yet been solved. As Mr. G. L. Beer says, "Modern English statesmen have not solved the difficulty; they have merely cut the knot!" Great Britain has learnt wisdom from Grenville's failure. But she has learnt it by bearing virtually the whole burden of the naval defence of the Empire till such time as the Self-governing Dominions, and other portions of the British Commonwealth of Nations, voluntarily afford—as they are now beginning to do—the support that she needs more and more. George Grenville, by precipitancy, broke up the Empire; the South African War of 1879, and still more the Great War of 1914, showed that Great Britain will secure, as a result of her patience since his time, the support of other parts of her Empire to an increasing degree. In this sphere of statesmanship, the policy of "Wait and See" has at all events been successful.

George Grenville was, especially when judged by the history of later events, certainly wrong in 1765; but some of the criticisms that George Grenville and Great Britain incurred over the Stamp Act, at the hand of many of the older historians, were certainly not deserved.

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Kite Balloons and Their Work

By P. H. Sumner, A.M.I.N.A.

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THE modern kite balloon was designed by Captain (now Major) Caquot, a French engineer. This replaced the old German type called the Drachen. The original Caquot balloon did not entirely fulfil the hopes of the small band of balloon enthusiasts, and further improvements were necessary to ensure stability in high winds. Finally Captain Caquot solved the problem by fitting the peculiar large stabilisers, or tails, which give the balloon a conspicuous, almost an uncanny, look. The first Caquot balloon arrived in England at the end of 1915, and in the summer of 1916 the exact prototype of the present balloon made its appearance. In the fittings to the balloon, and in smaller details of construction, improvements have since been made; otherwise it is essentially the same to-day as then.

The spherical balloon used for military observations in the past was not suitable for use as a captive balloon in high winds. This was because it drifted very much, so that for a small increase in altitude a large amount of cable had to be paid out. An increase in our knowledge of dynamics as applied to the air has made it possible for many defects to be eliminated, so that the drift of a captive balloon in high winds causes a deviation from the vertical position of the cable of a few degrees only. At the same time a strong head-to-wind position may be maintained even in winds of eighty knots (92 miles per hour). Spherical balloons used to spin round and become unmanageable in winds as low as twenty knots.

The spherical balloon is now used in the Service for training airmen. All airship pilots and balloon observers are required to pass-out a course in free ballooning, which includes a night flight and a solo flight (i.e. the pilot is alone in the balloon). The smaller spherical balloons have a capacity of 25,000 cubic feet; the larger, which can carry seven persons, a capacity of about 80,000 cubic feet. They are generally filled with coal-gas. The kite balloon, like the airship, is, however, filled with hydrogen gas. The envelopes of the old spherical balloons and airships were made of gold-beaters' skin, but nowadays all envelopes are made of cotton fabric rubbered on the inside. The rubber makes the fabric gas-tight; it also prevents impurities in the hydrogen from deteriorating the fabric.

The modern captive balloon is often popularly, but erroneously, called a "sausage." The sausage type,

the Drachen, originated in Germany, and is now obsolete. There is an American balloon, the Goodyear, which closely resembles the Drachen. It has sails and a parachute tail to assist its stability. The Italian balloon has an elliptically-shaped gas-bag provided

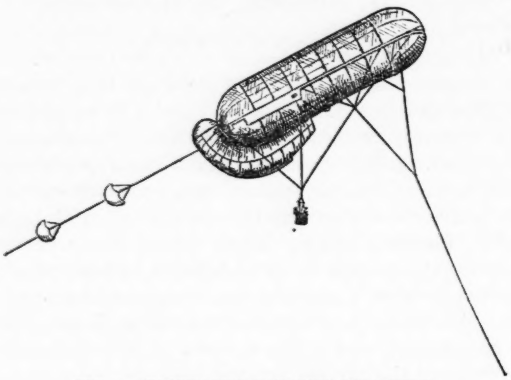

FIG. 1.—"SAUSAGE" BALLOON (DRACHEN).

with a conical-shaped tail filled with air, to which a rudder and stabilising fins are attached.

The French balloon, however, is the most important and most widely used. It is the standard for the Naval and Military Services of England and France.

The streamline form for a kite balloon is rather bluff (i.e. not sharp-pointed at the ends) and short compared with an airship. The latter has its centre of buoyancy, or central point of the lifting effort of the gas, immediately above the car. This allows a finer nose on the streamline. Conditions are different in the case of the kite balloon. Here the greater part

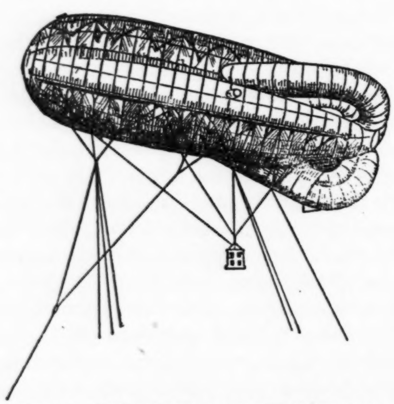

FIG. 2—STREAMLINE BALLOON (CAQUOT).

of the gas-lifting force is required to lift the cable, and bear the tension on the cable due to the wind forces on the balloon. A large amount of buoyancy is therefore needed about the nose, where the cable suspensions are attached, and that is why the balloon is given a "bluff" nose.

On the right-hand side of the balloon in Fig. 2 are seen the air-filled stabilising fins and the rudder. To these large fins the kite balloon owes much of its success.

Kite balloons, like airships, are provided with an internal air-chamber or "ballonet." The function of the ballonet is to keep the balloon rigid, and to provide an automatic means of operating the valve which releases the hydrogen from the envelope as the balloon ascends.

A kite balloon of capacity 35,000 cubic feet can be flown at altitudes up to 6,000 feet, carrying two observers. Such a balloon is about 91 feet long, and is the type used for "spotting" enemy batteries and for controlling gun-fire in military operations. For naval work, and for operations where great altitude is not of importance, a slightly smaller balloon has

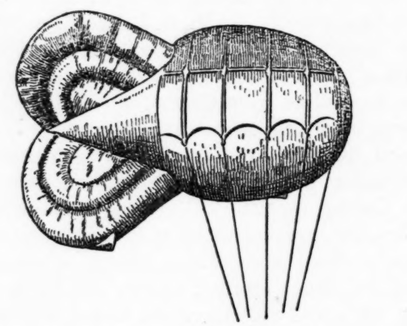

FIG. 3.—ITALIAN.

been found more convenient. During the war much valuable work was accomplished at sea in convoying ships, a lookout being kept for the wake of a submarine by the balloon observer. A submarine can be seen beneath the surface just as fish can be seen in a clear pond. The balloon is towed by a ship, usually a destroyer or a boat of the new "P" class, the observers in the balloon being in telephonic communication with the ship by means of a wire in the core of the cable. Messages may thus be sent without delay, enabling the ship on occasion to know the exact place and time to drop their depth charges so as to destroy the submarine. These charges take effect anywhere within 50 feet of the explosion, and their effect is felt in the balloon itself at altitudes from 600 to 1,500 feet. On one occasion a depth charge caused the magazine of a large U-boat to explode, and the effect was so far-reaching that many of our own ships, some even sixty miles away, felt it very much. In one instance the crew came up on deck expecting that the stern of the ship had been blown away, although in reality they were many miles from

the source of disturbance. Other ships felt that they had been lifted bodily out of the water.

Not a few convoyed ships owed their safety to the towing of a balloon which was carrying no observers.

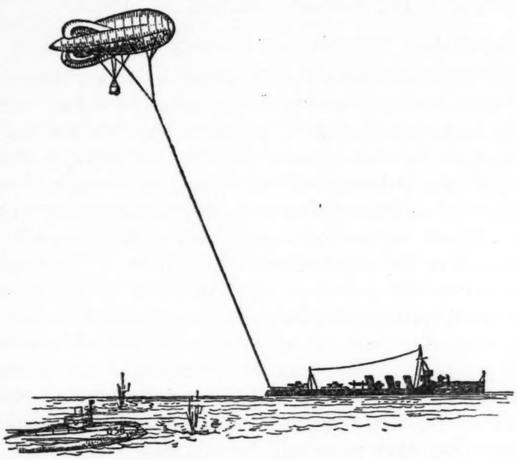

FIG. 4.—TOWING FROM DESTROYER IN ACTION.

The mere appearance of a balloon, empty or otherwise, made it advisable for the submarine commander to keep well below the surface. He was thus unable to come to the surface to attack our ship. Decoy balloons were just as effective in keeping the U-boats beneath the surface. These were small and cost little, and yet they deceived the enemy both as regards distance and object.

Kite balloons are capable of being released from the cable and given a free flight in the same manner as a spherical balloon. A kite balloon of 33,000 cubic feet capacity would reach an altitude of about 9,000 feet or more with two occupants when free.

Parachute descents afford, perhaps, the most thrilling experiences of balloonists in war. The parachute is to the airman what the lifebuoy is to the seaman—a means of saving life. Two parachutes folded in cases are always carried on the side of the balloon-car or basket. These are attached to harness worn by the occupants. A parachute is about 26 feet in diameter and is made of silk, so that it is easily folded into a small bulk. If the balloon is attacked, or if, for any reason, it is necessary for the occupant to quit the car, it is necessary for him to jump out. In doing so his weight snaps a small cord, or operates a spring, which opens the case and allows the parachute to glide out. It is not till the parachutist has fallen about 200 feet that the parachute has fully unfolded, and is then able to support his weight. This takes several seconds, and consequently it is rather a trying time for the parachutist. It is obvious that the folding of the parachute must be done with great care, and men are specially trained for the purpose, and the man who may have to do the jumping usually prefers personally to superintend this operation. There is a parachute called the "positive-opening" one, in which wooden ribs are automatically pushed out, forming the dome. This has not been used extensively with kite balloons. It is a recent development.

The speed of descent with a parachute is about 900 feet per minute. As to his landing-place the parachutist has to trust to luck. At sea he would be provided with a life-saving waistcoat, but on land he must just hope for the best. Sometimes the observers have drifted into the enemy's lines; on other occasions, after drifting towards the enemy's line, a wind in the opposite direction at a lower altitude has kept them on the right side.

One of the highest descents undertaken was made by a well-known airman from a spherical balloon about 10,000 feet up. The writer was told by the pilot that he was asked by the hesitating parachutist to push him off the edge of the basket. It cost the pilot nearly as much nerve to do this as to make the descent himself.

In France and Italy arrangements are made on some balloons for the complete basket and occupants to be released if necessary by the touch of a lever, the whole being supported by a parachute making a free descent. The gear has not found favour in this country. One of the objections to the arrangement is that in war an enemy gunner is less likely to attack a helpless man descending in a parachute, than a basket containing men who might be free to use firearms. Valuable instruments, and complete records of observations made, are saved by the basket method

FIG. 5.—BASKET METHOD OF DESCENT.

of descent. This, of course, would induce the enemy the more to shoot.

Kite balloons are sometimes unfavourably compared with airships, but a comparison of advantages is

hardly fair, as the nature of balloon-work may be in many cases entirely different from that of airships. A small airship is not capable of putting to sea in bad weather, and it is at all times dependent upon housing facilities on land. A balloon, on the other hand, can be kept at sea either aboard a ship or aloft. A balloon has been towed in the Bay of Biscay in winds approaching ninety miles per hour. In commercial life the kite balloon seems very useful in many undertakings. Large areas of unapproachable or untrodden land may be surveyed from photographs taken from balloons. Many rivers run in deep ravines, the precipitous rocks shutting out completely the view of the land beyond. In a balloon towed from a shallow-draught boat, a surveyor could obtain by photograph and from observation the data he needs for his map.

The captive balloon is also used in making meteorological observations. Periodical ascents are made at balloon stations for ascertaining weather conditions. A large observatory would find a kite balloon valuable for this class of work, and observations could be made up to heights of 14,000 feet.

During the war balloons were put to an ingenious use. Long wire streamers were lifted into the air, making an apron from one balloon to another. This formed part of the defence of London. Raiders had to risk being caught in the net, or forced to ascend to high altitudes, and thus lose accuracy in bomb-dropping.

In the future it is probable that kite balloons will be used as landmarks for the main aerial lines over the world. At landing-places for aeroplanes and airships they could exhibit lights or flares at night, possibly even display searchlights. At sea they could be anchored in much the same way as lightships are. It has also been suggested that balloons be used for locating shoals of fish. A suitable one for this purpose would cost about £800, and could be handled conveniently by a trawler.

Hydrogen is the best gas to use for filling a balloon because it is the lightest. The lifting-power of the balloon is proportional to the weight of a given volume of air minus the weight of the same volume of the gas used. It is thus greatest when the weight of the gas used is smallest. Helium, which is the second lightest gas known, has also been tried. It is twice as heavy as hydrogen, but its lifting-power is 92 per cent. of that of hydrogen. It is a rare gas, and so it is much more expensive than hydrogen. It has, however, the great advantage of not being inflammable, so that in war, where cost is of less importance than safety, it has obvious advantages. Helium is made on a large scale from natural gas in America.

The New Horizon in European Literature

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In the general stocktaking in which, as a preparation for reconstruction and new beginnings, we have all been instinctively indulging, literature has not had altogether its share. A reason lies probably in the elusive waywardness of all forms of imaginative activity; we feel that no amount of stocktaking and no schemes of reconstruction will avail in giving direction to the production of the future. Whatever new realms the poet is to conquer, on whatever new argosy of spiritual discovery he is to embark, he sets out with sealed orders; stocktaking is of little use to him, even in helping him to avoid the errors of his predecessors; the best of plans are ignored by the world-forces that control the evolution of æsthetic ideas. We may plan and forecast new conquests in chemistry, in biology, even in the more abstract sciences which trench on the borderland of metaphysics; but when it is a question of the new ideas which poetry is to embody, and the new forms it will assume, we can only patiently await events.

It is still too soon to report, as it is the obvious duty of Discovery, a modern Lynceus on its watch-tower, to report, on the progress of European literature " after the War." Literature has not yet progressed; it has not even clearly indicated how it is going to progress. Possibly we may have to wait some time for real signs. Such, at least, was the experience of the last European war, that of 1870-71, when the literatures of France and Germany proved strangely dilatory in adapting themselves to the new orientation; in fact, the real effect of that war on literature only became apparent when the generation that was mature in 1870 had abdicated, and the men born into the new era were old enough to take command. It may be so again.

Hypotheses of literary evolution can only be constructed on the analogy of the past. Now, how far may we avail ourselves of analogy in setting up a hypothesis of the lines on which imaginative work is likely to advance? In general, literatures are freakish, capricious, perversely undocile in their development—with perhaps the single exception of that of Germany. This, the most subjective and personal of them all, and consequently, one would expect, the least open to guidance, has shown itself quite extraordinarily ready to follow the lead of its theorists. The Germans, we other Europeans might say, have always put the cart before the horse; they have, since the sixteenth century, invariably theorised about their literature

before producing it, and their poets—even in revolutionary periods—have meekly resigned themselves to the dictates of criticism. Were other literatures conducted on similar orderly lines, it would certainly make our attempt to peer into the future an easier and more fruitful task than it is.

Some months ago an enterprising Scandinavian literary journal, *Litteraturen*, organised an inquiry on the probable effect of the European War on literature. The results were disappointing in so far as the part which writers other than Scandinavians took in it was small; three or four of our English writers responded, but France was hardly represented at all. From the replies one might conclude that the older generation is inclined to be sceptical of the good that will come out of the War: Dr. Georg Brandes, the doyen of Scandinavian critics, is, for instance, frankly pessimistic; to him the War has been merely the undoing of a century of literary evolution, a throwing back of Europe into barbarism. But Brandes' whole attitude to the events of the last five years has been, in spite of the liberation of North Slesvig, Poland, and Palestine, a peculiar one. On the other hand, the younger generation appear buoyantly confident that the new era will be really a new era, although they may not be very clear as to wherein the novelty shall consist. They hope, at least, that the literature of the future will be characterised by a larger-hearted humanity than the literature of the past, and will abandon its preoccupation with the individual, to seek inspiration in problems of society, of nation, of race. This, however, is an attempt to answer only half the problem; it leaves the question of the fashioning of the new literature untouched.

Beside a natural reluctance to take stock in literary matters, there is another factor which has to be reckoned with. Those whose business it has been to follow the evolution of literature in the past generation have a disheartening record to lay before us. Quite frankly, European literature had, in 1914, reached a point not very far off bankruptcy. We hasten, however, to add that we are not here thinking of individual achievement; but of the ideas, tendencies, and form of literature. The literature of the mid-nineteenth century—to look somewhat farther back—moved in all countries on a monotonous, uninspiring level; the dead hand of a moribund Romanticism—or was it the disillusionment of 1848?—lay heavy on it; we in this country called it Early and Mid-Victorian; and something very like Early Victorianism was to be seen in all the greater literatures of Europe, the representative writers being either belated romanticists or disgruntled revolutionaries. Only in the little nations, from the young and virile literatures of the North and, to some extent, from the grotesquely old-young literature of Russia, were new voices to be heard; but these voices were unable to gain much hearing amidst the general pessimism and conventionalism that held Europe in its bann. The first step towards regeneration is to be seen in the movement known as realism or naturalism. The generation that was young in the seventies and eighties of last century pinned their hopes on the new faith, flocked enthusiastically to its standard; literature, they proclaimed—unmindful of the fact that every fresh movement in literature justifies itself in almost identical terms—was to be no longer a juggling with threadbare motive and banal expression; it was to be life, to be a fresh vision of reality, reality "seen across a temperament." For a time all went well; the new wind swelled all sails; progress was rapid. Realism in literature became increasingly realistic; and before long the pioneers were set aside by a more resolute generation, who, accusing their predecessors of half-heartedness, unmasked their former leaders as really incorrigible romanticists at heart; a "consistent" realism took the place of a mere realism of "compromise." And then, with a suddenness which is not easy to account for, realism petered out. The ineradicable craving for something more inspiring than photographic truth reasserted itself; overnight realism had become out-of-date; even its most ardent adherents were forced to admit that their shibboleth was powerless to create a new heaven and earth in poetry. In its place came first what was camouflaged as psychological realism, then a new symbolism, a new spiritualism—all concessions to idealism, which were suspiciously like the old effete thing once repudiated and scorned as romanticism. The realistic creed disappeared amidst contemptuous phrases like *fin de siècle* and the like; once more a new foundation was laid down, and the optimists were confident that on it the twentieth century might hopefully build. If literature, they said, can widen its spiritual horizon and still maintain that sense for reality acquired in the previous period, it may escape the danger of drifting back into the deadening conventionalism under which latter-day romanticism had suffered. But the new formula, the second within the experience of one generation, proved to be no more a remedy for the decadence than its predecessor. The post-realistic movement was ineffectively tentative, without whole-hearted backing; its timid and hesitating experimenting was no substitute for the discarded realism; and thus, when 1914 came, literature was still in most countries floundering in the morass of "fin-de-sièclism."

This, briefly, is the main reason why literary stock-taking has not been an alluring or profitable undertaking in these times; we have had nothing very creditable to take stock of. But there is a brighter

side to the confession of failure ; it is the most valid of reasons why the future should be faced with hopefulness. The War has been to many the end of an old bad period. Does not, indeed, Professor Babbitt, in his latest book, ***Rousseau and Romanticism***, even hint that it was a kind of Nemesis upon us for not having got rid of our romantic ideas long ago ?

What has history to tell us of the effect of national wars on literature ? The generation of to-day, schooled in a more critical scepticism, cannot answer this question with the same easy confidence as their Victorian predecessors ; it used to be a commonplace to say that periods of expanding national life, of great wars and great victories, inspire great literatures. We talked with full conviction of a Periclean Age and an Elizabethan Age and all that such phrases implied. But the study of the psychology of nations has tended to discredit such simple theories ; the relationship between literature and national life is a more subtle and complicated thing than was once believed ; we are not now so sure that Elizabethan poetic greatness had much to do with the Spanish Armada. The rôle of literature seems, in fact, rather to be prophetic, a foreshadowing rather than a consequence of political and social movements. Take, for instance, the literature of Germany in the generation that precipitated the catastrophe ; it did not exactly predict the War, but it displayed, for those who saw beneath the surface, the kind of mentality which made the War possible and even probable. Moreover, the foreshadowing of coming events is to be found not so much in literature itself as in the interpretation a people puts upon its literature ; it is rarely due, unless in quite minor manifestations, to any conscious collusion on the part of the poets with the spokesmen of national aspiration. One thinks of Nietzsche, whose whole system of thought, essentially anti-Prussian and even anti-German, became perverted in the imagination of his countrymen to provide a justification for aggressive Prussianism. And most revolutionary dramas are not discovered to be revolutionary until they are performed in the theatre.

Of the aloofness of literature from great political cataclysms there is no lack of striking illustration. Can one honestly say, for instance, that the reflex of the French Revolution in literature is even remotely commensurate with the significance of that upheaval ? Here, again, there is more French Revolution in the literature of Europe before 1789 than after that year. And how little can we point to in English literature as the poetic sublimate of the Napoleonic Wars ? Political poetry is notoriously an inferior brand ; it does not stand the test of time. Thus we are not at all sure that the literature of the future, either amongst the victorious nations or with the Germans—and it is by no means a matter of course that the advantage in these things lies with the victor—will bear upon it signs of regeneration directly traceable to the struggle. The real business of literature—*pace* the school of critics which holds that the vitality of literature consists in its capacity for bringing problems under debate—is with matters foreign to the clash of political ideas. Indications are not wanting, indeed, that the new literature may even begin by setting itself resolutely to ignore the War ; and will rather seek in remote, imagined worlds, a relaxation from the strain of the intolerable five years.

But to the literary historian the vital question is : Will literature succeed in disengaging itself from the catchwords and coterie-spirit of the past ; will it escape from the eternal see-saw of classicism and romanticism, which has dominated literary evolution since the Renaissance ? Can the circle of necessity, the " ewige Wiederkehr " of the Nietzschian philosophy, be broken? Or are we doomed to go on through another century helplessly oscillating between the old opposites of individualism and collectivism, realism and idealism ? Bearing in mind the ineradicable romanticism of the nineteenth century, we may reasonably look to the future for a reversion to collectivism—and in literature collectivism is usually synonymous with classicism—look for greater literary solidarity among the nations. Twice, and twice only, in the past, has all Europe been inspired by the same ideals, has thought and felt as one great nation ; the first time was in the epoch of the Crusades, the second in the eighteenth century. It surely does not savour too much of prophecy to say that the twentieth century will probably resemble the eighteenth rather than the nineteenth. But the solidarity of the future must not mean, as too often in ages of classicism, the negation of individualism. It has been decreed that the rights—and these surely include the thought and literature—of the little nations are to be henceforth held sacrosanct ; individualism must be a factor in the new solidarity ; in any case, it is inconceivable that Europe should ever again resign itself to the grip of an ice-age like that of pseudo-classicism. Thus the problem of the immediate future will be, it seems to us, to find a formula that will reconcile the collective and the individualistic spirit in literature. And if we are not mistaken, there are some signs of a development of this kind in the smaller nations themselves ; we are thinking more particularly of Scandinavia. The mere desire on their part to be known sympathetically to the great world outside brings with it an ambition to speak a common language of thought and emotion ; to set forth their individual contributions to thought, not in the old, aggressively national spirit of the romanticists, but in an honest effort to win understanding for them.

But this, we fear, is not " discovery " ; it is at best but a reasonable anticipation. We trust that future issues of this Journal may, as the horizons become clearer and as opportunities offer, testify to the shaping of the new literatures and to the spirit in which they are facing the tasks that lie before them.

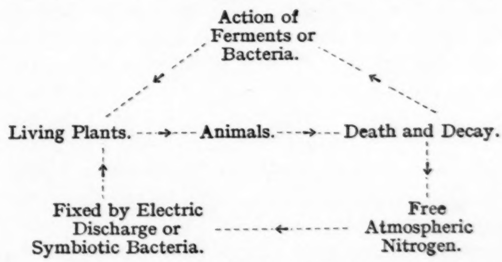
The Source of Nitrogen, Old and New

By Edward Cahen, A.R.C.Sc., F.I.C.

All living plants and animals require nitrogen if they are to exist, and in addition to this, man, the noblest of all the animals, uses this element in huge quantities for the purpose of putting an end to existence by means of his great invention—firearms.

The earth on which they have their being is a sphere of some 8,000 miles in diameter, around which there is an envelope about twenty miles deep of air, four-fifths of which is nitrogen, and yet these plants and animals, with but few exceptions, are unable to make use of all this good nourishment unless it is specially prepared for them. As far as one can see, this enormous quantitiy of nitrogen is merely mixed with the oxygen to dilute the latter for our consumption. Rutherford (1772) is usually credited with the discovery of nitrogen. He burnt various elements, such as phosphorus and carbon, in air, and observed that what was left had lost something; he therefore called the residue " phlogisticated air." It was not till much later that Chaptal (1823) gave it its present name Nitrogen, from the Greek νίτρον (saltpetre) and γεννάω (I produce), in reference to its existence in this material. Nitrogen is one of the most ubiquitous of elements; not only is it a constituent of all living plants and animals, and supplies four-fifths of our atmosphere, but it is also found in some nebulæ in the heavens, and has been discovered hidden away in many minerals. If agriculture is to be developed, a supply of suitable nitrogen must be found. At first, of course, the manure from stables and cowsheds was enough to meet the small demands; but, when more and more land came under cultivation in the course of the ages, more and more fertilisers had to be found. A fruitful source of supply in the past has been the saltpetre beds in the rainless region on the West Coast of South America—in Peru, Chili, and Bolivia; but, large as this source is, it cannot last for ever at the rate at which it is being used up. Although in 1873 there existed some 550 square miles of these beds in large flat basins between the ridges of the Tarapueca plateau, every square mile of which was capable of producing about four million tons of the precious material, it was estimated that these beds could not last much more than a hundred years. There is another disadvantage about a source of nitrogen so far across the seas, and that is, it is not always available. A war arises, a blockade is declared, and the supply is cut off at just that time when it is most needed for the making of munitions. Not only during this war has the lack of nitrates made itself felt, but even during the Napoleonic Wars, France was in such desperate straits for the lack of them for making gunpowder that she had to resort to what were known as " nitre-plantations." These were simply great heaps of manure protected from the rain and allowed to rot; in course of time several different kinds of bacteria set to work and converted the nitrogen into nitrates. This method of obtaining nitrates is still resorted to in hot countries such as Bengal. In this connection it is interesting to speculate how the Chili deposits of nitrate got there; the problem in point of fact is a very difficult one, and has not yet been solved in a satisfactory manner. It is thought that the sodium nitrate might be of animal origin, but in that case, where the phosphates which must at one time have been associated with them have gone to, is more than one can tell.

In nature there is a complete cycle round which the available nitrogen moves: the verdure covering the surface of the world is consumed by the animals; these die and decay, part of the nitrogen going back into the soil to nourish the vegetation, part returning into the atmosphere, where a thunderstorm, with its flashes of lightning, soon oxidises it to nitric acid, which dissolves in the rain and so is returned to earth. This cycle is not quite so simple as I have described it, but a glance at the diagram will at once make matters



clear. The symbiotic bacteria in the diagram are rather interesting little bodies; they live in a sort of partnership in nodules on the roots of plants, mostly of the bean family (Leguminosæ), and in return for their board and lodging they make the atmospheric nitrogen palatable for the plants, their landlords. It was perhaps to be expected that, when the natural sources of nitrates began to get more scarce and more difficult to come by, the ingenuity of man should be

attracted to the vast quantities of nitrogen in the air as a possible source of supply, if only a means could be found of converting the nitrogen into nitrates at a reasonable cost. In solving this problem, perhaps the greatest problem of the day, the scientists first of all turned to nature to find out how she accomplished the process, and to see whether they could not take a leaf out of nature's book. Now, if we glance at the nitrogen-cycle diagram above, we at once see two methods suggested, both of which have since been imitated on a commercial scale with success; and in addition two new methods have been discovered which are capable of competing with the Chili saltpetre on a commercial basis. Of these four methods only one is independent of cheap electrical power; this is based on the culture of nitrogen-fixing bacteria, the symbiotic bacteria to which reference has already been made. This was done by Nobbe and Hiltner in 1896, who sold these cultures for soil inoculation under the trade name of "Nitragen."

The electrical methods are, however, of much greater interest, and appear also to be sounder commercial propositions as well.

Of these the *Norwegian Process*, as it is often called, was based on an experiment of Cavendish (1785), though really it only reproduces on a small scale exactly what happens during a thunderstorm. Cavendish's experiment was in itself only a refinement of one performed by Priestly (1779); it merely consisted in passing sparks in a small quantity of air in an enclosed space; he thus caused a little of the nitrogen to combine with the oxygen to form oxides of nitrogen, which dissolved in water, with the production of nitric acid. The miniature thunderstorms of Cavendish and Priestly were improved upon by Siemens and Halske (1902). They arranged a powerful arc light in an enclosed space through which air could be drawn; then they spread the flame of the arc with a strong electro-magnet, thus getting the maximum volume of flame from the minimum of current. As the air was drawn through this immensely hot flame, combination took place, and oxides of nitrogen were formed. From these beginnings the process of Birkeland and Eyde (1905) was developed, until to-day in Norway, where electric power is cheap owing to the abundance of waterfalls, huge generators are producing nitric acid directly from the air. In its broadest outlines the process is not difficult to describe. A current of many thousand volts produces an enormous flaming arc between terminals of copper tubing, through which water continually flows; the whole is enclosed in a furnace-like box of brick with metal casing. An alternating current is employed so that the arc passes from pole to pole every one-fiftieth of a second, and in addition a powerful electro-magnet spreads the flame. Through this arc, resembling a great ball of flame some 6 feet across, a current of air is allowed to pass, and in its passage the nitrogen in it partially combines with the oxygen, its partner, to form oxides of nitrogen. The gases are then drawn off up a series of towers, where they come into contact with dilute nitric acid and milk of lime. This latter combines with the nitric acid, and the salt (calcium nitrate) resulting from this combination fixes the atmospheric nitrogen in a form suitable for use as a fertiliser. This is sold as Norwegian saltpetre. Such a process, however, is only possible where very cheap electric power, obtained from a natural source, is available; two other processes have for this reason been developed, which are capable of being run on commercial lines from power derived from coal. Both of them depend on the production of ammonia from nitrogen, separated from the air, by making it combine with hydrogen, a matter of no small difficulty, for nitrogen is, with the exception of the rare gases of the atmosphere helium, argon, xenon, neon, and krypton, perhaps the most inert of all the elements. This inertness of nitrogen is very curious, when one considers how extremely active this element becomes, for good and evil, when properly combined. Not only are the fertiliser and the explosives industries at the mercy of the nitrogen atom, but the dyeing industry as well owes its being to this remarkable element.

The first of these two processes is usually referred to as the *Cyanamide Process*, because this compound is the characteristic feature of the method. As yet Norway is the home of this process, but it is a British company that is responsible for the operations involved. Calcium carbide, the familiar material used for the production of acetylene gas, is first of all manufactured on a gigantic scale. Lime and coal are heated together in an electric furnace the temperature of which reaches something like 3,000° C. The carbide, after cooling, is ground to a fine powder in an atmosphere of nitrogen, a precaution which is necessary so as to avoid explosions, which might otherwise take place from the accidental production of acetylene. Incidentally use is here made of the inertia of nitrogen, a property referred to above.

The powdered carbide is then placed in large cylindrical furnaces, through the solid lids of which a carbon electrode passes down the centre of the furnace. Nitrogen is kept percolating through the powder, and the temperature is gradually raised to about 1,100° C. by the current till combination takes place and cyanamide is formed. This substance, a compound of calcium, carbon and nitrogen with some free carbon, which is liberated during the reaction, is known commercially as "nitrolim." The nitrogen used in the manufacture of cyanamide from calcium carbide is

itself a by-product in the Linde or liquid-air process for the preparation of oxygen from the air. The nitrogen can be used directly as a fertiliser, and it can also be converted by suitable treatment into ammonia or the cyanides, which are used in countless metallurgical processes. If nitric acid is required, this can be obtained from the ammonia by making use of a catalyst. These substances are of great importance to the chemical manufacturer, for though they bring great changes about, they themselves remain unchanged at the end of the operation. Spongy platinum, which by the way is now worth more than £40 an ounce, is the catalyst used in this case, so perhaps it is fortunate that it suffers no change in the operation, and can be used time after time. That this process was employed during the war in Germany and the United States is now common property, and it is rumoured that a plant is to be set up on one of our coal-fields, from which the power is to be derived. That this is a commercial proposition in times of war has been proved by both Germany and the United States; whether it will pay in times of peace is another matter, and a point that the future alone will decide.

We now come to the last process, the much discussed *Haber Process*, named after the inventor. Essentially this is a process for the production of ammonia synthetically from its elements nitrogen and hydrogen, a matter of no little difficulty, as I have already indicated above, on account of the lazy habits of the element nitrogen. By means of a suitable catalyst this can, however, be brought about. As in the cyanamide process, the nitrogen is first separated from the oxygen; the hydrogen is obtained by blowing steam on to an incandescent mass of partly coked coal. The gaseous ingredients are then mixed in the right proportions, heated and subjected to the action of pressure and a catalyst. Round the choice of a suitable catalyst and the proper pressure to use the controversy has raged. Several catalysts have been used; finely divided pure iron, osmium and uranium may be mentioned here. However, the fact remains that, under these somewhat exacting conditions, nitrogen may be prevailed upon to enter into partnership with hydrogen, although somewhat reluctantly. This process, which was originally a jealously guarded secret of Germany (a secret which no doubt saved them from collapse due to a lack of munitions), is one to the perfection of which a great deal of patient research has been devoted. The object of this research has been to find the best working conditions, to produce the greatest yield of ammonia at the lowest figure. This latter point is very important in times of peace, when other sources of nitrates are available. Only a few days after the publication of the long-delayed "Report of the Nitrogen Products Committee," *The Times* announced that the rights of the new French *Georges Claude Synthetic Ammonia Process* had been secured for the United Kingdom and the Colonies by the Cumberland Coal, Power, and Chemicals, Ltd., who intend erecting works in the West Cumberland coal-fields as quickly as may be. This new process was developed by M. Georges Claude at the works of the Grande Paroisse, Montereau, near Fontainebleau, and differs from the Haber process in several very important essentials. The chief of these appears to be a matter of pressure; whereas the Germans used a comparatively low pressure of from 150 to 200 atmospheres, the new process employs as many as 1,000, or 14,000 lb. to the square inch. The advantage gained in increased yield compensates for the increased cost of producing this enormous pressure. It is estimated that the first Synthetic Ammonia Plant to be erected will be capable of producing some 50,000 tons of ammonium sulphate annually. This process is particularly suitable for this country, where we have no great natural sources of electrical energy, but good supplies of coal, which at any rate are adequate for our present needs. At a time such as the present, when so much is being done to revive agriculture in this country, and when freights are so high, it is a matter of the greatest importance for these islands to be rendered independent of other countries in the matter of fertilisers. The outlook for the future is rather more hopeful if these two great schemes to which I have referred culminate in success. During the war a great deal of the most useful research has been done on this subject, and the recommendations in the report of which mention has already been made seem likely to bear fruit in the near future. The Government erected a huge factory at Billingham-on-Tees, but this had not been used when the Armistice put an end to the war and the immediate need for nitrates for explosive purposes. The factory is now for sale, and there seems no reason why it should not be turned to the use for which it was designed. Should it be found possible to render this country independent of foreign fertilisers, the benefit will be found in another way: agriculture will become far more intensive, imports of foodstuffs will diminish, and our exchange will again tend to be stabilised, a condition which is devoutly to be hoped for in the not distant future.

NOTE.—Several illustrated articles have appeared in the *World's Work* on this subject, and there is a popular article, with some good illustrations, in the January number of *Conquest*. Any large textbook on Chemistry gives a description of the several methods. The "Report of the Nitrogen Products Committee" just issued discusses the matter very fully in all its bearings. This is a most important report. In vol. vi of *A Textbook of Inorganic Chemistry*, edited by Newton Friend, and published by Charles Griffin, will be found a very full description of Nitrogen. This volume is in the press.

Jute-Dyeing

THIS fibre is one of the most interesting, if not one of the most important, that finds great and growing application in the textile industry, possessing many qualities that are not shared by other fibres of similar origin, and which are valuable factors in directing its use for the manufacture of certain classes of fabric that are of considerable commercial value.

To many persons jute is synonymous with burlap, which is used for bag manufacture; but since processes have been found that enable the fibre to be bleached and dyed in a satisfactory manner, the plebeian idea of the use of jute must be set aside and a more refined position given it.

A tour through any of the large department stores in large cities in America, or inquiries at any interior decorating establishment, will convince anyone regarding the wide range of uses to which jute is put, while its popularity from an artistic standpoint will not be overestimated.

The jute plant has been known and raised in India from the very earliest times for the valuable properties of its fibre, but it has only been since the beginning of the nineteenth century that the systematic treatment of the plant for its fibre for use in textile manufacturing received any attention. As a matter of fact, the only textile manufacture that jute was consumed in for many years was the manufacture of continually increasing quantities of bagging for use in baling the American crop of cotton. It was not until the late sixties or early seventies that jute bagging became the article almost exclusively used for this purpose, and consequently the jute industry—not alone from the agricultural viewpoint, but from the manufacturing viewpoint as well—has increased to immense proportions, and there is a prospect that it will continue to grow, for the reason that we have not in sight any other fibre that is fully able to take its place.

Jute fibres are obtained from that part of the plant known as the bast, which consists of that portion of the stalk next to the outer crust or rind. This appears, when viewed under the microscope, to be made up of innumerable "bundles," which are actually the fibres of commercial value. The scientific name is *Corchorus capsularia*, while the common names are too numerous to be given.

The plant grows to a height of from 5 to 10 feet, the average diameter of the stalk being over half an inch, with few branches except near the top. While the jute plant had been cultivated in many parts of the world, India retains its pre-eminence in this regard, the greatest crops of the fibre being raised in Bengal.

The commercial fibre is separated from the plants by treatment with cold water; the leaves, branches, and capsules are removed from the stalks. These are immersed for several days in a stream of slowly moving water, at the end of which time the fibre portion may be removed without any difficulty, and in considerable purity. The dried fibre is made up into bundles, the length of which varies from 6 to 8 feet. For textile manufacturing purposes, not all of this length is utilised; about 12 to 14 inches from the thick end is usually cut off, and finds its outlet in the manufacture of paper stock, under the name of "jute butt." That portion of the fibre used for textile purposes is softened with an emulsion of soap and oil, and is afterwards hackled and spun into threads, and then woven into cloth, or otherwise utilised.

Jute, unlike many of the vegetable fibres, though used for coarse fabrics, requires considerable care, as it is incapable of resisting harsh treatment.

While there are known a number of practical processes for bleaching jute, the one yielding perfect results is yet to be discovered. Those which follow, however, are to be recommended only by the fact that they are at this date actually used in various mills where jute is treated.

For Jute Pieces.—Pass through a ½ per cent. solution of silicate of soda, heated to 160° F., then through a second solution of sodium hypochlorite of such strength that the vat does not contain more than 1 per cent. of chlorine available for bleaching as determined by a volumetric test. This hypochlorite is made by acting on a fresh solution of bleaching-powder with one of soda ash, adding the latter until no further precipitation of calcium carbonate is noted, let settle, and draw off the clear portion for use, diluting with water until the proper strength is obtained.

After passing through this solution, the goods are well washed and passed through a weak muriatic acid solution, to which has been added a small quantity of sulphurous acid. This treatment is to ensure the removal of certain substances that tend to discolour the otherwise bleached material, and also to remove the small quantity of iron that is always found in the crude jute fibre. Finally, wash well and dry, but, if it is intended to print colour on the fabric, pass the cloth through a solution of bisulphate of soda containing about 2 per cent. of sulphurous acid, squeeze the excess of liquor out of the cloth, allow it to lie covered with damp burlap for three or four hours, and afterwards dry over cans. This treatment leaves only neutral sulphite of soda on the fibres, which does not affect the printing colours during steaming, but preserves the fibre against the oxidising action of the steam-chest atmosphere. The loss in weight by this process is sometimes as great as 8 per cent.

Another process is to subject the jute alternately to the action of potassium permanganate and sodium bisulphite, but the cost is against it, although the results are very good when properly conducted.

A perfect bleach is almost impossible to secure, as the fibre will not stand the necessary treatment. The only way to obtain passable results is to bleach with the first process above indicated, and then to make use of a tinting blue, for which purpose some of the so-called "soluble blues" answer very well.

Jute, like all the other fibres of similar origin, is not very difficult to dye; but unlike most fibres, unless some special care is taken, uneven results will always be obtained,

owing to the great affinity that the fibre has for most colours.

At the present time, three broad classes of dyestuffs are required as being of particular interest to the jute-dyer—namely, the basic, acid, and direct colours, each class having advantages over the others according to the uses to which the dyed fabric is to be put.

Dyeing Jute with Basic Colours.—Prepare the dye-bath by heating the water to about 80° or 90° F., work the jute for a few moments to ensure that it is evenly wetted, and then add a portion of the dyestuff, previously dissolved in warm water; gradually increase the temperature to 175° F., at the same time making further additions of dyestuff until the proper depth of shade is required. Move about in the dye for twenty to thirty minutes after the last addition, and then lift, wash, and dry.

Some basic colours may be dyed at a temperature of 180 to 190 degrees at the start, but they are so few that it is unnecessary to mention them. Others of this same class require for the best results the addition of a small quantity of acetic acid, usually a pint to a kettleful of water; such dyes being the methyl violets and malachite (acid) green.

Dyeing Jute with Acid Colours.—These colours always yield the brightest shades, and are applied to jute from a dye-bath made slightly acid with about 2 per cent. of oil of vitriol, together with 5 per cent. of alum.

The colour is added slowly during the heating of the bath until it boils, when the steam is shut off and the yarn or pieces worked for half an hour. Lift, wash, and dry.

Dyeing Jute with Direct Colours.—This class of colours is always applied to jute from an alkaline or neutral bath, and is receiving very great attention from dyers and manufacturers of burlap for interior decorations, for which purpose these dyes are better suited than any others, as they are fixed more permanently upon the fabric, and do not fade under the influence of light.

A general recipe for dyeing yarn is as follows:

1 to 3 lb. direct colour.
10 to 20 lb. Glauber's salt.
$1\frac{1}{2}$ to $2\frac{1}{2}$ lb. soda ash.

Put in the yarn at 180° F., raise the temperature to the boil, and keep boiling for one hour, or until the bath is exhausted or the proper shade is obtained. With light percentages the colour is quickly taken up, but with heavier shades it will be found economical to maintain the standing kettle. Lift, wash well, and dry.

Burlap for decorative purposes is always dyed in the piece, and with colours that will not be acted upon by the glue sizing that is put on the back of the finished fabric. Some manufacturers are using casein as size for the burlap and with very good results. For dyeing the piece-goods burlap, a padding machine is always employed, as this enables the dyer to obtain in a very short time the heavy shade usually required. The colour-bath is made up with a very small quantity of water, just sufficient to fill the box of the machine, and to this is added a small amount of some soluble thickening

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such as dextrine or casein. This latter product has many advantages over any other similar material, and yields very good results on the finished piece.

The "colour" is made up in a cask or barrel, without any other addition than the thickener, and then poured into the "sow-box," or trough of the machine, giving the pieces two runs in opposite directions so as to secure shades. The padded goods are well squeezed through nipping-rollers, and then dried and "backed." The temperature of the colour-paste should be boiling or nearly so, because the higher the temperature the better the penetration.

Printed patterns or designs are often applied to jute, and the process is exactly the same as for calico-work, except that the colour-paste is made very much thicker, and that the colour in a number of instances is not fixed by steaming.

Often white figures are printed upon the dyed burlaps, these being made up of white pigment, such as *blanc fixe* thickened with albumen or casein.

As a wall-covering burlap is certainly one of the most satisfactory to be had, and it will no doubt continue to increase in popularity.

The Treasures of Coal-Tar

If you put a bit of soft coal into a test-tube (or, if you haven't a test-tube, into a clay tobacco pipe, and cover it over with clay) and heat it, you will find a gas coming out at the end of the tube, that will burn with a yellow smoky flame. After all the gas comes off you will find in the bottom of the test-tube a chunk of dry, porous coke. These, then, are the two main products of the destructive distillation of coal. But if you are a born chemist, with an eye to by-products, you will notice along the middle of the tube, where it is neither too hot nor too cold, some dirty drops of water and some black, sticky stuff. If you are just an ordinary person you won't pay any attention to this, because there is only a little of it, and because what you are after is the coke and gas. You regard the nasty smelly mess that comes in between as merely a nuisance, because it clogs up and spoils your nice clean tube.

Now, that is the way the gas-makers and coke-makers—being for the most part ordinary persons, and not born chemists—used to regard the water and tar that got into their pipes. They washed it out so as to have the gas clean, and then ran it into the creek. But the neighbours—especially those who fished in the stream below the gas-works—made a fuss about spoiling the water, so that the gas-men gave away the tar to the boys for bonfires or sold it for roofing. But this same tar, which for a hundred years was thrown away, and nearly half of which is thrown away yet in the United States, turns out to be one of the most useful things in the world. It is one of the strategic points in war and commerce. It wounds and heals. It supplies munitions and medicines. It is like the magic purse of Fortunatus, from which everything wished for could be drawn. The chemist puts his hand into the black mass and draws out all the colours of the rainbow. This evil-smelling substance beats the rose in the production of perfume, and surpasses the honeycomb in sweetness.

It is interesting to recall that anæsthetics like novocaine and stovaine are derived from coal-tar; antipyretics like aspirin, acetanilid, and acetphenetedin; specifics such as adrenaline prescribed for Addison's disease, soamin and arsacetin for sleeping sickness, salvarsan for blood disease, and phenolphthalein used as a laxative. Saccharin, dulcin, and other sweeteners are obtained from the same source; essences like cinnamon and coumarin; photographic developers of various kinds; lyddite, melinite, and trinitrotoluol (called TNT for short), which did such destructive work on the battle-front in Europe. So diverse are the products that it seems incomprehensible that all can be found in one original product.

In the distillation of coal-tar we obtain from the light oil such products as benzol, toluol, xylol, pyridine, phenol, and cresol. From the middle oil we get naphthalene, and from the heavy oil comes anthracene. The refined tar and the pitch left as a residue have their uses. Great industries have been built upon each and every one of these remarkable products, and the chemists have only begun their work in this line. The future is full of possibilities.

Royalty and the Royal Society

By Philip D. Rogers

The recent election of H.R.H. The Prince of Wales to the Fellowship of the Royal Society affords a fitting opportunity to recall the relationship which has always existed between the Throne and that eminent scientific body; a relationship which now dates back for nearly 260 years.

Owing to the fact that so many of the present generation have, in their youthful studies, been nourished on Macaulay, it is not altogether surprising to find that most of them are content to accept without demur the numerous political and personal calumnies which have been heaped upon the heads of the Royal House of Stuart. Without wishing to embark upon any historical controversy, let it be said at the outset that King Charles II, in founding the Royal Society, performed an act the far-reaching results of which might well commend him to posterity as a second Solomon. Writing in 1667, Spratt says of the founding

and patronage of the Society by the King: "An enterprise equal to the most renowned actions of the best Princes. For, to increase the powers of mankind, and to free them from the bondage of errors, is a greater glory than to enlarge empires, or to put chains on the necks of conquered nations." The Charter of Incorporation is dated July 1662, and in the April of the following year, a second Charter granting further privileges passed the Great Seal. A third Charter was granted in 1669, but it is by that of 1663 that the Society has since been governed. The King continued to take a deep interest in the progress and welfare of his new foundation, an interest which was shared by his brother, James, Duke of York, and by his cousin, Prince Rupert; the latter, though best known as the dashing leader of the Royalist Cavalry during the Civil War, was also distinguished for his interest in Science, and for his service to Art by introducing into England mezzotint engraving, a process he had learnt directly from the inventor, L. von Siegen.

In 1663 a warrant was issued authorising the delivery of "one guilt mace, being a gifte from His Maiestie." This mace was for many years believed to be identical with the famous "bauble" so rudely dealt with by Cromwell, but the discovery, in 1846, of the original warrant mentioned above finally dispelled this belief. An engraving of the Society's mace, however, actually appeared as an illustration in Scott's *Woodstock*,[1] accompanied by a statement that it represented the "bauble mace" belonging to the Long Parliament. King Charles also granted to the Society very honourable Armorial Bearings, which are described in the second Charter as follows: "These following blazons of honour, that is to say, in the dexter corner of a silver shield our three Lions of England, and for Crest a helm adorned with a crown studded with florets, surmounted by an eagle of proper colour holding in one foot a shield charged with our lions; to be borne, exhibited, and possessed for ever."[2]

In the Society's Charter Book, a superbly emblazoned volume bound in crimson velvet, with gold clasps and corners, the first three signatures are—CHARLES R., Founder,—JAMES, Fellow,—RUPERT, Fellow. In connection with this historic tone the following entry was made by Samuel Pepys in his *Diary* under the date January 9, 1665: "I saw the Royal Society bring their new book wherein is nobly writ their Charter and Laws, and comes to be signed by the Duke[3] as a Fellow; and all the Fellows hands are to be entered there, and lie as a Monument; and the King hath put his with the word Founder." In

[1] Abbotsford Edition of *The Waverley Novels*.
[2] Translated from the original Latin.
[3] James, Duke of York, afterwards King James II.

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passing it may be mentioned that the famous Diarist was President of the Society for two years, from 1684 to 1686.

At one of the early meetings of the Society a poisoned dagger, sent by His Majesty, was laid before the Fellows; it had originally been received by the King from the East Indies. "The dagger was warmed, and with it blood was drawn from a kitten, to see whether it would be killed thereby. The kitten not dying while the Society were together, the operator was appointed to observe what should become of it." At the meeting in the following week, however, the kitten was produced alive—a sound testimony to the feline legend of nine lives! Incidentally it is interesting to note this experiment as one of the early forerunners of vivisection.

The records of the Society contain several references to their Royal founder, witnessing his continued interest in the progress of Science. It is related that the King ordered Sir Robert Gourdon to send the Society a recipe to cure hydrophobia, invented by his physician, Thomas Frasier; this recipe, needless to say, is very typical of the medical science of the seventeenth century, and consists *inter alia* of roots, leaves, crabs' claws, milk, and Venetian treacle; a truly alarming compound!

The long reign of King Charles II terminated in the year 1685, and his name will ever be honourably associated with the Royal Society, as their Founder and first Patron. No efforts appear to have been made, however, to obtain the patronage of his brother and successor, James II, although, as mentioned above, he was already a Fellow of the Society. William III and Mary, too, do not seem to have taken any active interest in the progress of their predecessor's foundation; their names, together with that of Queen Anne, constitute the only three omissions from an otherwise unbroken chain of royal signatures from 1662 down to the present day. In 1705 Queen Anne was petitioned by the President, Council and Fellows for a grant of land "to build a place of their own to meet in nearer to Westminster"—a petition to which she made no response. Nevertheless, seven years later, she was pleased to intimate her intention of countenancing and encouraging the studies of the Society. This she proposed to do by instructing her Ministers and Governors abroad to promote the Society's interests "by corresponding with the Fellows and procuring answers to such enquiries on scientific matters as may be sent to them from time to time in their several stations." The Queen's husband, Prince George of Denmark, was elected a Fellow in 1704, and the Council desired the President and Secretary to wait on the Prince with the Charter Book, "to have the honour of his subscription." Prince George also munificently undertook to bear the cost of publication by the Society of Flamsteed's *Historia Coelestis Britannica*; this had previously been estimated at between eight and nine hundred pounds.

The First George of England and Hanover, after having conferred his patronage on the Society by signing the Charter Book, was petitioned in 1724 by the President, Council and Fellows to grant a licence to purchase or hold lands, manors, tenements, etc., in Mortmain. This Petition, which was signed by Sir Isaac Newton as President, was referred to the Attorney-General to consider and report upon, and, in consequence of his favourable verdict, was duly granted by His Majesty.

In 1727 the President, Sir Hans Sloane, proposed that an address of loyalty should be presented to King George II, and after several long discussions this address was drawn up; it included also a humble petition for the Royal protection and patronage. A deputation consisting of the President, the Duke of Richmond, and other Members of Council, conveyed it to the King, and it is recorded that "His Majesty was pleased to receive the gentlemen in a most gracious manner, and did the Society the honour to write his Royal name in the Charter Book as their Patron; and that upon waiting on the Queen with a compliment, Her Majesty had likewise been pleased to receive them very graciously."

A similar loyal address was presented to King George III shortly after his accession in 1760, and was conveyed by a deputation consisting of several of the Fellows headed by the President, the Earl of Macclesfield, who relates that "The King was pleased to receive them very graciously—all the Members had the honour of kissing his hand; and His Majesty afterwards sent for the President into his closet, and signed his Royal name in the Charter Book, and was pleased to express a great regard for the good of the Society." The notable progress made by the Royal Society during his reign affords ample evidence of this regard. Shortly afterwards the Dukes of York and Cumberland were elected Fellows. It is pleasant to note that the King's interest was before long evinced in a very substantial form when, in response to a humble request for funds to send out expeditions to distant stations to observe the forthcoming Transit of Venus (1769), His Majesty at once directed that a sum of £4,000 should be paid from the Treasury for this purpose. Three parties were eventually sent out, one to Hudson's Bay, one to Madras, and one to the Pacific; in command of the last-named party was Lieutenant James Cook, afterwards, of course, the famous navigator; on this occasion he hoisted his pennant in the *Endeavour*. Several years after these expeditions had been successfully carried out, a depu-

tation of the Council, headed by their President, Sir John Pringle, waited on the King humbly to express their most grateful thanks for his benefaction; His Majesty received them most graciously, and conferred the distinction of knighthood on James Burrow, the late President.

In the year 1777 a heated discussion concerning the relative merits of pointed and blunt lightning conductors, which had originated in the scientific world, developed into a controversy of considerable political importance, and, for the first and last time in its history, the Royal Society—or rather its President—was brought into direct opposition with the Throne. The King, having for political reasons adopted the blunt form of conductor on his palaces, endeavoured to make the Society rescind its resolution in favour of the pointed variety, and in an interview with Sir John Pringle urged him to use his influence in support of the Royal wish. The President, however, replied to the effect that, although duty would always induce him to carry out His Majesty's wishes to the utmost of his power, he was unable to reverse the laws of nature. Whereupon King George is said to have replied, "Then, perhaps, Sir John, you had better resign"; and at the following anniversary Sir John resigned the presidency, though Dr. Kippis, his biographer and intimate friend, denies that his resignation was due to this cause.

Science in general, and the Society in particular, suffered a heavy loss in the death of George III at the beginning of the year 1820; his reign—one of the longest and most illustrious in our history—marked an epoch greatly enlightened by the accomplishments of many famous scientific men.

Shortly after the accession of King George IV the customary address of loyalty to the Sovereign was presented, and it is recorded that His Majesty was graciously pleased to become the Patron of the Society. Within the first few months of his reign he issued a Royal Warrant appointing the President and certain of the Fellows to be Visitors of his Royal Observatory at Greenwich. In 1825 the President—Sir Humphrey Davy—received a communication from Sir Robert Peel intimating that the King proposed to found two gold medals of the value of fifty guineas each for the most important discoveries, or series of investigations, completed to the satisfaction of the Society within the five years preceding the award. The Council thereupon resolved "that the offer contained in this letter be most gratefully accepted, and that the humble and dutiful thanks of the President and Council be respectfully returned to His Majesty for this instance of his munificence, and of his disposition to promote the objects of the Royal Society, and the general interests of Science." These medals were known as

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the Royal Medals, and bore on the obverse the effigy of the King, and on the reverse the statue of Newton in Trinity College Chapel, Cambridge; they are still awarded annually, the names of the proposed recipients being submitted to the Sovereign for approval before they are finally awarded.

On the death of George IV in 1830, his brother, the Duke of Clarence, succeeded to the throne as King William IV, and to him the Society forthwith tendered its loyal address. The new King immediately consented to become the Patron of the Society, and, having signed the Charter Book on a page especially illuminated for him, declared that "he would be proud to take every opportunity of promoting the interests of an Institution, whose great object is the cultivation of science and the discovery of truth." In 1833 the King signified his intention of restoring the foundation of the Royal Medals, which had been in abeyance during the three preceding years, and for this purpose he sent the Society a set of revised regulations governing the award of these medals. For a period of eight years just covering the reign of William IV the Society had the great honour of a very close connection with the Throne, its deliberations being presided over by a Prince of the Blood Royal. At the Anniversary Meeting in 1830, H.R.H. The Duke of Sussex, sixth son of King George III, was elected President, and continued to hold this office until 1838. Throughout this time the Duke guided the proceedings of the Society with an energy and zeal fully characteristic of the generous interest which had always been shown towards scientific matters by his House.

On the death of her uncle, Queen Victoria graciously signified her intention of becoming the Patron of the Society, and approved the continuation of the annual grant of the Royal Medals. The Prince Consort was elected a Fellow in 1840, and Edward, Prince of Wales, in 1863; the latter became Patron of the Society on his accession in 1901. His present Majesty was elected when Duke of York in 1893, and was formally admitted in 1902, when Prince of Wales. He also at his accession graciously consented to become Patron of the Society.

Other Royal Fellows of recent years include H.R.H. The Duke of Connaught, elected in 1906, and his son Prince Arthur, who became a Fellow in that most momentous year of the Empire's history, *anno belli* 1914.

The Royal Society has a membership at present of about four hundred and sixty members. Each year in May fifteen new Fellows are elected from about a hundred candidates. Fellowship of the Royal Society is one of the highest honours that can be given to a scientist.

Reviews of Books

The Art of the Greek Vase Painter: a Handbook of Greek Vase Painting. By MARY A. B. HERFORD, M.A. (Manchester University Press, 9*s.* 6*d.* net.)

More patient research has perhaps been expended in recent years on the fascinating study of Greek Vase Painting than on any other branch of ancient archæology; and so fruitful have these investigations proved, and so positive in their results, that the time has come when the student should no longer be obliged to collect his information from articles scattered about in learned periodicals or the descriptions of museum catalogues. In Mr. H. B. Walters' *History of Ancient Pottery* we have, it is true, an excellent manual of a wider scope; but a compact handbook dealing with the narrower subject of Greek Vase Painting has been a desideratum both of the archæological student and of the general reader.

It is to the former rather than to the latter that Miss Herford's book will appeal. We are inclined to think that the general reader, who approached the subject with no previous knowledge of this or any other branch of ancient art, would find too much discussion of technical questions, and too little stress on the æsthetic and human side. Miss Herford's interest is primarily in the technical side, and her account of this is exactly what the student has long required.

Part I of the Handbook deals with the technique of the Greek vase and the status of the potter (it is interesting to note that after the Peloponnesian War the wages of the craftsman were 100 per cent. higher than before), the shapes, and the use of vases. Part II (Historical) deals with the evolution of the art of vase-painting in Greek lands and Italy. The treatment of the earlier period appears to be more adequate than that of the later, particularly of the South Italian wares. It may be regretted that additional chapters were not devoted to discussing the light thrown by Greek vase paintings on contemporary life and literature and on mythology; also that the numerous references enclosed in brackets in the text were not relegated to the bottom of the pages.

The illustrations, which are necessarily restricted in number, are well chosen and include a number of interesting vases which have never been published before. It is obvious, however, that the student will require frequently to refer to the catalogues of the great collections to which Miss Herford gives frequent references.

Miss Herford's book is certainly one which adequately fills a gap in the library of the archæological student. To all those who are interested in the progress of the new Universities it must be a matter of gratification that such a book as this should have been produced by an archæologist trained in the University of Manchester, and the daughter of one of its most distinguished professors.

The form and printing of the volume are admirable.

E. S. F.

Russia in Rule and Misrule: a Short History. By BRIG.-GEN. C. R. BALLARD. (John Murray, 6*s.* net.)

General Ballard has taken on a job similar to that of the Scottish probationer who announced from his pulpit, one Sunday morning, that he was going to preach on the subject, "God, Man, and the Universe," and would devote ten minutes of his time to each. The probationer was a trier, who believed in compression; and very probably his sermon was an excellent one.

The author of this book has been successful in his task, the heavy task of giving a clear and interesting account of the chief events in the history of Russia, from the earliest times to the events of 1918, in a book of about two hundred pages. His sources of information are entirely Russian, drawn from the standard histories, from newspapers and pamphlets, and from personal talk with Russians during the war years, so that we get a point of view expressed which is missing in many histories and accounts of Russia.

The larger portion of the book is devoted to the events of the past twenty years, the troublous time of the late Tsar, the Russo-Japanese War, the Great War, the revolutionary movement, and the doings and misdeeds of the Bolsheviks. Very interesting is the description of how King Edward, by his tact and kindness, improved the strained relations between Russia and ourselves after the Japanese War. It is also pointed out what a tragedy for Russia, as well as for ourselves, was the loss of Lord Kitchener in the *Hampshire*. In the description of the war and the revolutionary movement the author is writing with first-hand knowledge, and one feels that an accurate account is being given of much that has hitherto been uncertain.

The book is a plea for a sane interest in Russia. It emphasises the fact that Russia is not just a political problem, a country we praise to the heights one year, and curse to the depths the next, but a country of Europe with a language worth knowing, and a literature worth reading, and a history and geography worth studying—a big country in every way, whose present situation and future possibilities deserve the attention of thinking men. P. K. F.

Poetry and Commonplace. By JOHN BAILEY. (Oxford University Press, for British Academy, 1*s*. 6*d*. net.)

This is a quiet and pleasant essay, delivered to the British Academy on November 26, 1919, on the relation of poetry to commonplace, using this word not in the bad sense of what is "trite" and "obvious," but in the better sense of "a great saying of universal application." If poetry be granted to deal, above everything else, with truth, then it must of course deal with things which are most universal, which is precisely the stuff of commonplace. The essayist points out that the greatest poets are concerned not so much with creating new ideas, and inventing new ways of expressing themselves, as in making poetry out of the things of ordinary life, and out of truth which is old and known. They have, of course, the power of invention, but side by side with this, and of greater importance, is their power of rediscovery. By rediscovery is meant not a new emphasis of the obvious, or an expatiation on a theme with which everybody is familiar, but something which makes us see new truth and new beauty in old things, and makes us not merely know these things, but have that perception of them which Wordsworth called "the breath and finer spirit of all knowledge." This relation of poetry to commonplace is illustrated by examples from several of the great poets, especially by examples from Wordsworth. Says the essayist, "He [Wordsworth] lives to-day less by his original creative side, the side of discovery as I called it, than by his singular genius for rediscovery, by his gift for making the dry bones of all sorts of commonplace live, the commonplaces of life, of language, and of thought"; and again, "the essential business of Wordsworth was to make a primrose by a river's brim more than that to everyone who reads: to bring out the strangeness of the common, the interestingness and newness and significance of the commonplace."

The poetry of the Psalms, of Homer, Horace, Gray, Meredith, Tennyson, and, coming to our own day, of Mr. de la Mare, furnishes the essayist with further illustrations of his theme. P. K. F.

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Springtime and other Essays. By SIR FRANCIS DARWIN, F.R.S. (John Murray, 7s. 6d. net.)

The happy title has much to do with the book's finding favour in our eyes. What it suggests of life and freshness is fulfilled in the table of contents—a procession, if we may borrow the author's word, of delights, the mere reading of which perhaps leads us to expect too much. Such magic words as "Dickens' Letters," "Recollections," "Instruments of Music," "Traditional names of English Plants," make us turn over the leaves with eagerness. A slight feeling of disappointment is inevitable when we realise that the treatment of these charming subjects is somewhat light and superficial.

It is true that the botanist teaches us much, and his flower cycles and name-stories are valuable as well as beautiful additions to our knowledge of plant life; but many of our old literary favourites are condemned in his less happy essay on "Names of Characters in Fiction."

The review essays are well done and condense long biographies for us, giving admirable pictures of their subjects and wise selections of their writings and *bons mots*. It is an ideal book for the poet's "Shady Nook."

M. R.

An Amazing Séance and an Exposure. By S. A. MOSELEY. (Sampson Low, 3s. net.)

It is difficult to realise what good purpose is served by the publication of this little book.

It is the work of a journalist who evidently has written up his experiences in a great hurry. The author's purpose is to present a straightforward record of an independent investigation into the claims of spiritualism. He attended many séances, and he had many curious experiences. He became, as a result, a convinced spiritualist.

We hold the conservative view that the investigation of spiritualistic phenomena is best done by men trained in pathology, psychology, and in conjuring. The opinions of men who have had no opportunity of special training, however honest and *bona fide* they may be, cannot be considered of any value.

A little less ingenuous credulity and a development of the critical faculty would assist things enormously. For example, a man who goes to séances and gets his ears boxed and has another person's braces deposited in his lap should insist on having the gas lighted. (We don't pretend to any originality in making this suggestion, but it is a helpful one). The presence of a material thing like light would help material people like ourselves enormously, and should have no effect on a spirit, and it would certainly lead to less involved explanations of the things that occur.

Electric Spark Ignition. By J. D. MORGAN. (Crosby Lockwood, 8s. 6d. net.)

Jane's Pocket Aeronautical Dictionary. (Sampson Low, 1s. 6d. net.)

Mr. Morgan gives an account in this little book of the scientific basis of the subject of electric spark ignition in internal combustion engines. It is of interest and use to the people for whom the compilation of information has been made, namely designers and students working on the subject of petrol-engines. At the end of each chapter references to further information on the subject dealt with are given.

The *Aeronautical Dictionary* is a useful book to anyone who wishes to know the meaning of technical and slang terms used in connection with aircraft.

The Turks in Europe. By W. E. D. ALLEN. (John Murray, 10s. 6d. net.)

To read of the arrival of the Turks into Europe as the coming of an obscure tribe of nomad *shepherds* may be a revelation to many of us. But such they were, and Mr. Allen has given us a most concise history, from the thirteenth century to the year of the outbreak of the war. It is more than a history. It is an interpretation, and one may read it as easily as a romance—but a romance over which falls the shadow of the sword.

The story consists chiefly of the record of fighting, pillage, murder, and violence, yet the author has made the Turks interesting and even understandable.

After reading the book, the enigmatical mentality of the Turks seems nearer a solution, and we understand why, although he has been in Europe so long, the Turk has never been of Europe.

The future of Turkey and of the Turks is one of the most important problems that the result of the war has set our statesmen, yet most of us know very little of this race. We should thus especially welcome Mr. Allen's book.

M. R.

OTHER PUBLICATIONS RECEIVED

(We hope to deal with several of these in future issues.)

Instincts of the Herd in Peace and War. By W. TROTTER. (Fisher Unwin, 8s. 6d. net.)

An Introduction to Physics. By R. A. HOUSTOUN. (Longmans, 6s. net.)

Heredity. By J. ARTHUR THOMSON, 3rd Edition. (John Murray, 15s. net.)

Streamline Kite Balloons. By CAPT. P. H. SUMNER, R.A.F. (Crosby Lockwood, 10s. 6d. net.)

Studies in Mental Inefficiency. Vol. i, No. 1. (The Central Association for the Care of the Mentally Defective, 9d. net.)

Religion and Culture. By FREDERICK SCHLEITER, Ph.D. (Columbia University Press; London: Milford, 8s. 6d. net.)

Meteorology for All. By D. W. HORNER. (Witherby, 6s. net.)

The Practical Book of Interior Decorating. By H. D. EBERLEIN, A. MCCLURE, and E. S. HOLLOWAY. (Lippincott, 35s. net.)

The Quantitative Method in Biology. By PROF. JULIUS MACLEOD. (Manchester University Press, 15s. net.)

Economics for To-day. By ALFRED MILNES, M.A. (Dent, 3s. 6d. net.)